73 AMATEUR RADIO

International Edition

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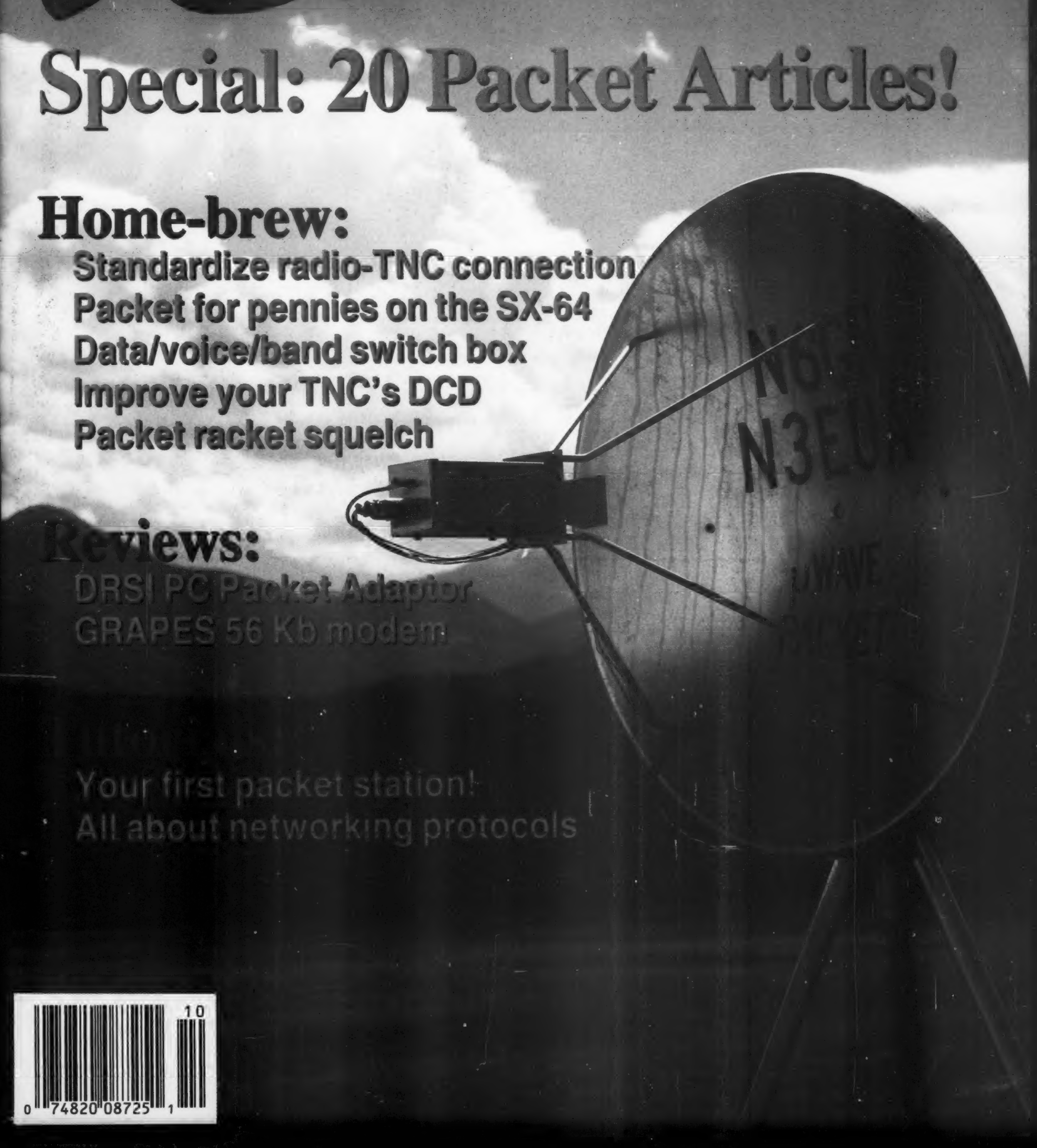
A WGE Publication

Special: 20 Packet Articles!



Home-brew:

Standardize radio-TNC connection
Packet for pennies on the SX-64
Data/voice/band switch box
Improve your TNC's DCD
Packet racket squelch

Reviews:

DRSI PC Packet Adaptor
GRAPES 56 Kb modem

[illegible]

Your first packet station!
All about networking protocols

0 74820 08725 1 10

ICOM
IC-2400 UHF/VHF Mobile
IC-2500 UHF/
146.700
442.000

NOW YOU DON'T HAVE TO DOUBLE UP!

Stack today's rapidly expanding VHF/UHF action in your favor with the most advanced design yet easy-to-operate FM dual banders on the road: ICOM's IC-2400 2-meter/440MHz or IC-2500 440MHz/1.2 GHz.

Their overlapping band ranges are great for present use and future expansions, and their wide array of impressive features make your auto a double-mobile winner!

WIDEBAND COVERAGE.

The IC-2400's range of 138-174MHz RX/140-150MHz TX and 440-450MHz RX/TX includes NOAA weather reception plus liberal overlap for MARS/CAP operation. The innovative IC-2500 receives and transmits 440-450MHz and 1240-1300MHz.

HIGH POWER RADIOS!

The IC-2400 delivers 45 watts output on two-meters, 35 watts on 440MHz. The IC-2500 features 35 watts on 440MHz 10 watts on 1.2GHz. Both units include selectable low power for working local stations.

FULL DUPLEX OPERATION.

Both transceivers transmit on one band while simultaneously receiving on another. Both radios feature independent offsets for each band. It's like having two separate radios in one! Perfect for true telephone-style autopatching with a modern crossband repeater!

SIMULTANEOUS DUAL BAND RECEPTION.

Monitor both bands on the internal speaker or add external speakers. Each band features separate volume and squelch controls.

40 MEMORIES.

Twenty per band. Store frequencies, PL tones and TX offsets for super-convenient mobiling!

PROGRAMMABLE BAND AND MEMORY SCANNING.

You set the limits and select/lockout preferred memories. ICOM's IC-2400 and IC-2500 monitor the action. A sheer VHF/UHF delight!

Additional features include: **Priority Watch.** Monitor one channel's activity while operating on another frequency. **Two Call Channels.** One on each band for quick, single access to your favorite repeater. A **Repeater Input Monitor Switch** for rapid checks of TX offset and evaluation of direct range. Plus, an **Optional Beeper** silently monitors any selected frequency or repeater for calls with your preselected CTCSS subaudible tone.

Double your bands with ICOM's new IC-2400 or IC-2500 mobiles!

ICOM America, Inc., 2380-116th Ave. N.E., Bellevue, WA 98004
Customer Service Hotline (206) 454-7619
3150 Premier Drive, Suite 126, Irving, TX 75063
1777 Phoenix Parkway, Suite 201, Atlanta, GA 30349
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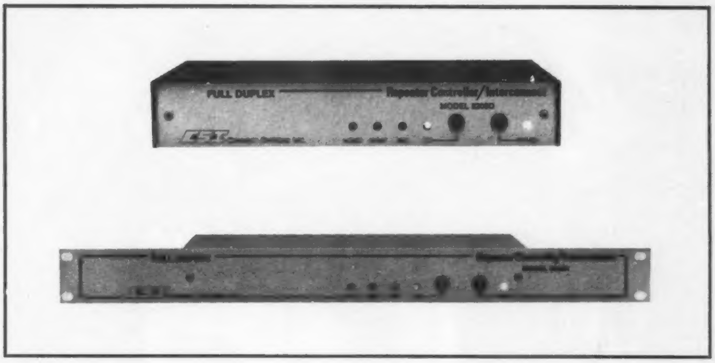
All stated specifications are subject to change without notice or obligation. All ICOM radios significantly exceed FCC regulations limiting spurious emissions. 2400/2500789

ICOM
First in Communications

CIRCLE 354 ON READER SERVICE CARD

NO OTHER FULL DUPLEX PATCH OR REPEATER CONTROLLER GIVES YOU SO MUCH FOR SO LITTLE



FULL DUPLEX AUTOPATCH USING DUAL BAND RADIOS...

Most people are within radio range of their base station 90% of the time. Why not install an 8200 and enjoy your own private full duplex mobile telephone system? Only 3 connections are required. The 8200 provides both full duplex and half duplex operation.

(Inquire about Private Patch V for simplex operation. Operates in enhanced sampling or VOX modes...user selectable.)

ADVANCED AUTOPATCH FEATURES...

The 8200 incorporates many features which are simply not available in any other product. For example...

90 Phone Number Auto Dialer: The 8200 will store (in non-volatile memory) 90 phone numbers which can be dialed with abbreviated two digit key codes. The auto dialer is programmable over the air or with the built-in keyboard.

Last Number Redial: Redialing the last number called is reduced to a single digit (plus access code).

Hookflash: Operates call waiting etc. Simply press * three times. Only CSI has it.

Call Progress Tone Detection: Busy signals and second dial tones are detected and cause automatic disconnect. Ample time is allowed for dialing second dial tones when required.

Powerful Toll Protection: One to four digit sequences can be restricted. For example, you could lock out 0, 1, 976 and 911. Additionally, digit counting will prevent dialing more than 10 digits. A separate 2 to 6 digit toll override code allows making toll calls when desired. Re-arm is automatic.

Dial Access Remote Base: The 8200 can be accessed and controlled from any telephone. Call up and drop into the system from your desk phone at lunch hour!

Ringout Selective Calling: Ordinary calls can be received using ringout (reverse patch) and mobiles can be selectively called using regenerated DTMF.

Optional ANI access codes: This option will allow up to 50 separate (remotely programmable) 1 to 6 digit access codes. A call can only be disconnected with the code that initiated the call. Thus eliminating sabotage disconnects.

AN ADVANCED REPEATER CONTROLLER...

The 8200 is a powerful repeater building block and is perfect for all private and club systems.

The 8200 contains everything necessary to convert any receiver and transmitter into a powerful repeater. Only one connection to the receiver and two to the transmitter are required.

Menu style programming is accomplished with the built in keyboard and display. The user can select a 3 digit repeater up/down code, CW ID message, CW ID interval, hang time, activity timer time, and you can even select any Morse character as a courtesy beep!!

An optional plug-in CTCSS board converts the 8200 to private use. The incoming CTCSS is filtered out and replaced with fully regenrated tone. 32 tones are dip switch selectable.

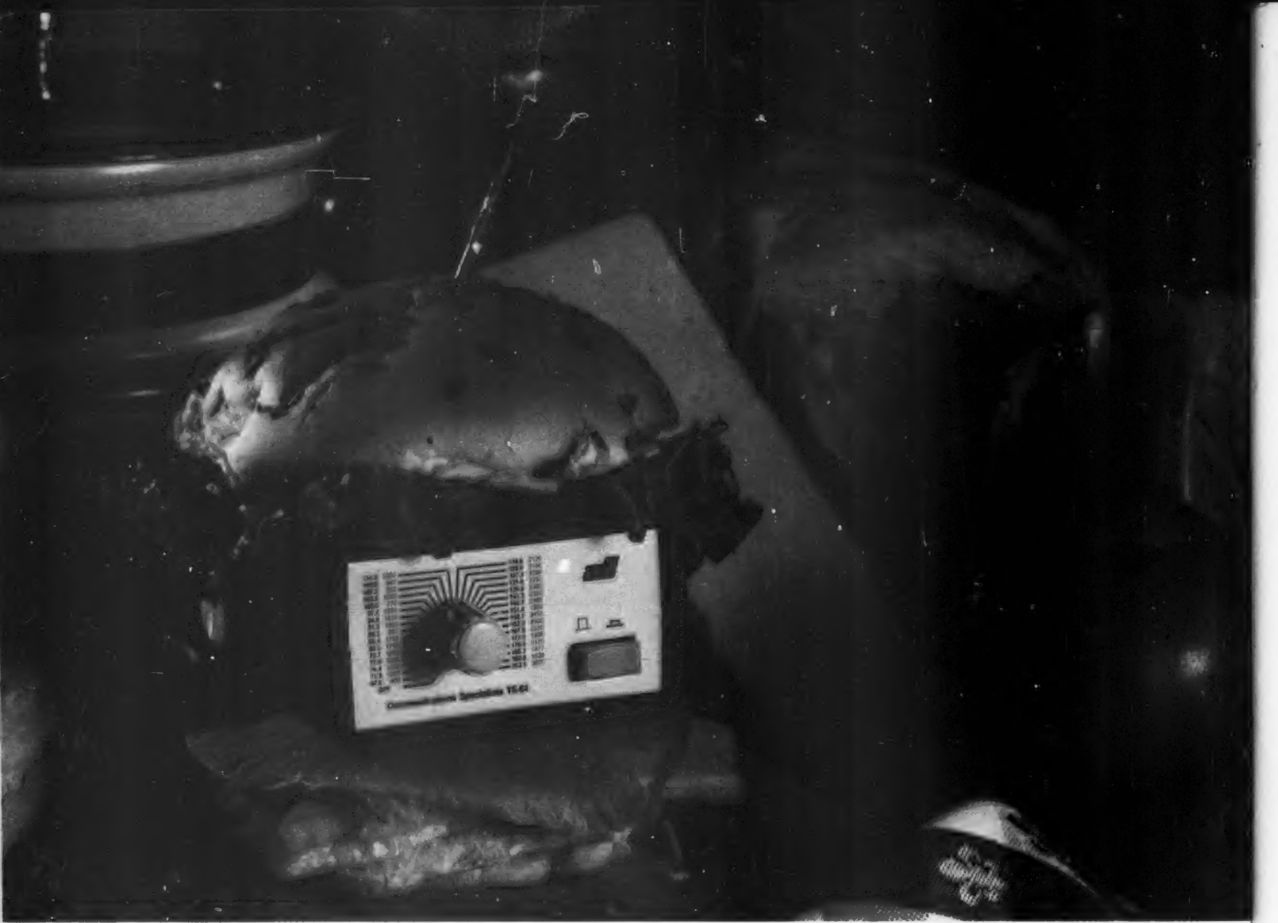
STANDARD FEATURES...

- Line in use detection
- 90 number auto dialer
- Redial
- Hookflash
- User programmable CW ID
- Regenerated tone/pulse dialing
- Selectable activity, timeout and hang time timers
- 3 digit repeater on/off code
- Two remotely programmable 1-6 digit autopatch connect codes. (Regular and Toll Override)
- Powerful toll protection
- Remotely controllable relay (relay optional)
- Ringout (reverse patch)
- Busy channel ringout inhibit
- Ring counting
- Auto answer
- Telephone remote base
- DTMF-DTMF selective calling
- Courtesy beep (any Morse character)
- Automatic busy signal and dial tone disconnect
- MOV lightning protectors
- Non-volatile memory

And MUCH more!

CONNECT SYSTEMS INC.
2064 Eastman Ave. #113
Ventura, CA 93003
Phone (805) 642-7184
FAX (805) 642-7271

CIRCLE 12 ON READER SERVICE CARD



Food for thought.

Our new Universal Tone Encoder lends its versatility to all tastes. The menu includes all CTCSS, as well as Burst Tones, Touch Tones, and Test Tones. No counter or test equipment required to set frequency-just dial it in. While traveling, use it on your Amateur transceiver to access tone operated systems, or in your service van to check out your customers' repeaters; also, as a piece of test equipment to modulate your Service Monitor or signal generator. It can even operate off an internal nine volt battery, and is available for one day delivery, backed by our one year warranty.

- All tones in Group A and Group B are included.
- Output level flat to within 1.5db over entire range selected.
- Separate level adjust pots and output connections for each tone Group.
- Immune to RF
- Powered by 6-30vdc, unregulated at 8 ma.
- Low impedance, low distortion, adjustable sinewave output, 5v peak-to-peak
- Instant start-up.
- Off position for no tone output.
- Reverse polarity protection built-in.

Group A

67.0 XZ	91.5 ZZ	118.8 2B	156.7 5A
71.9 XA	94.8 ZA	123.0 3Z	162.2 5B
74.4 WA	97.4 ZB	127.3 3A	167.9 6Z
77.0 XB	100.0 1Z	131.8 3B	173.8 6A
79.7 SP	103.5 1A	136.5 4Z	179.9 6B
82.5 YZ	107.2 1B	141.3 4A	186.2 7Z
85.4 YA	110.9 2Z	146.2 4B	192.8 7A
88.5 YB	114.8 2A	151.4 5Z	203.5 M1

- Frequency accuracy, ± .1 Hz maximum - 40°C to + 85°C
- Frequencies to 250 Hz available on special order
- Continuous tone

Group B

TEST-TONES:	TOUCH-TONES:		BURST TONES:			
600	697	1209	1600	1850	2150	2400
1000	770	1336	1650	1900	2200	2450
1500	852	1477	1700	1950	2250	2500
2175	941	1633	1750	2000	2300	2550
2805			1800	2100	2350	

- Frequency accuracy, ± 1 Hz maximum - 40°C to + 85°C
- Tone length approximately 300 ms. May be lengthened, shortened or eliminated by changing value of resistor

Model TE-64 **$79.95**

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DEPARTMENTS

FEEDBACK... FEEDBACK!

It's like being there—right here in our offices! How? Just take advantage of our FEEDBACK card on page 17. You'll notice a feedback number at the beginning of each article and column. We'd like you to rate what you read so that we can print what types of things you like best. And then we will draw one Feedback card each month for a free subscription to *73*.

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100 Dealer Directory
17 Feedback
83 Ham Help
17 Ham Profiles
88 Index: 10/89
92 Letters
8 Never Say Die
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10 GHz 1 Megabit per second packet station, designed by Bdale N3EUA and Glenn N6GN. See page 28 for more on this system. Cover by Alice Scofield.

"JS" VU2JX, a happy DXpeditioner to the-Laccadives. Read about the trip on page 96.

BEST OF MFJ

MFJ, Bencher and Curtis team up to bring you America's most popular keyer in a compact package for smooth easy CW

VOLUME
SPEED
AUTO
MFJ ELECTRONIC KEYER PADDLE
MFJ PACESETTER
MFJ ELECTRONIC KEYER PADDLE

MFJ-422B

$129.95

The best of all CW worlds - a deluxe MFJ Keyer using a Curtis 8044ABM chip in a compact package that fits right on the Bencher iambic paddle!

This MFJ Keyer is small in size but big in features. You get iambic keying, adjustable weight and tone and front panel volume and speed controls (8-50 WPM), dot-dash memories, speaker, sidetone and push button selection of automatic or semi-automatic/tune modes. It's also totally RF proof and has ultra-reliable solid state outputs that key both tube and solid state rigs. Use 9 V battery or 110 VAC with MFJ-1305.

The keyer mounts on a Bencher paddle to form a small (4 1/8 x 2 5/8 x 5½ inches) attractive combination that is a pleasure to look at and use.

America's favorite paddle, the Bench, has adjustable gold-plated silver contacts, lucite paddles, chrome plated brass, and a heavy steel base with non-skid feet.

You can buy just the keyer assembly, MFJ-422BX, for only $79.95 to mount on **your** Bencher paddle.

Artificial RF Ground

MFJ-931
$79.95

You can create an artificial RF ground and eliminate RF "bites", feedback, TVI and RFI when you let the MFJ-931 resonate a random length of wire and turn it into a tuned counterpoise. MFJ-931 also lets you electrically **place a far away RF ground directly at your rig** - no matter how far away it is -by tuning out the reactance of your ground connection wire. 7½x3½x7 in.

Antenna Bridge

MFJ-204B
$79.95

Now you can quickly optimize your antenna for peak performance with this portable, totally self-contained antenna bridge.

No other equipment needed - take it to your antenna site. Determine if your antenna is too long or too short, measure its resonant frequency and antenna resistance to 500 ohms. It's the easiest, most convenient way to determine antenna performance. Built-in resistance bridge, null meter, tunable oscillator-driver (1.8-30 MHz). Use 9 V battery or 110 VAC with AC adapter,

Super Active Antenna

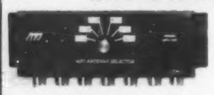
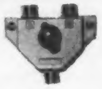
'World Radio TV Handbook' says MFJ-1024 is "a first rate easy-to-operate active antenna ... quiet ... excellent dynamic range ... good gain ... very low noise factor... broad frequency coverage ... excellent choice."

Mount it outdoors away from electrical noise for maximum signal, minimum noise. MFJ-1024 covers 50 KHz to 30 MHz

Receives strong, clear signals from all over the world. 20 dB attenuator, gain control. ON LED Switch two receivers and aux. or active antenna. 6x23x5 in. Remote unit has 54 inch whip, 50 ft. coax and connector. 3x2x4 in. 12 VDC or 110 VAC with MFJ-1312,

MFJ-1024 **$129.95**

MFJ Coax Antenna Switches

$34.95 MFJ-1701 **$21.95** MFJ-1702 **$59.95** MFJ-1704

Select any of several antennas from your operating desk with these MFJ Coax Switches. They feature mounting holes and automatic grounding of unused terminals. They come with MFJ's one year **unconditional** guarantee.
MFJ-1701, $34.95. Six position antenna switch. SO-239 connectors. 50-75 ohm loads. 2 KW PEP, 1 KW CW. Black aluminum 10x3x1½ inch cabinet.
MFJ-1702, $21.95. 2 positions. Cavity construction. 2.5 KW PEP, 1 KW CW. Insertion loss below .2 dB. 50 dB isolation at 450 MHz. 50 ohm. 3x2x2 in.
MFJ-1704, $59.95. 4 position Cavity Switch with Lightening/Surge protection device. Center Ground position. 2.5 KW PEP, 1 KW CW. Extremely low SWR. Isolation better than 50 dB 500 MHz. Negligible loss. 50 ohm. 6¼x4¼x1¼ in.

"Dry" Dummy Loads for HF/VHF/UHF

MFJ-260 **$28.95** **MFJ-262** **$69.95** New **MFJ-264** **$109.95**

MFJ has a full line of dummy loads to suit your needs. Use a dummy load for tuning to reduce needless (and illegal) QRM and save your finals.
MFJ-260, $28.95. Air cooled, non-inductive 50 ohm resistor. SO-239 connector. Handles 300 watts. Run full load for 30 seconds, derating curve to 5 minutes. SWR less than 1.3:1 to 30 MHz, 1.5:1 30-60 MHz. 2½x2½x7 in.
MFJ-262,$69.95. Handles 1 KW. SWR less than 1.5:1 to 30 MHz. 3x3x13 in.
MFJ-264, $109.95. Versatile UHF/VHF/HF 1.5 KW Dry Dummy Load. An MFJ first. Gives you low SWR to 650 MHz, usable to 750 MHz. You can run 100 watts for 10 minutes, 1500 watts for 10 seconds. SWR is 1.1:1 to 30 MHz, below 1.3:1 to 650 MHz. 3x3x7 inches. SO-239 connector.

MFJ-1286 Gray Line DX Advantage

New **$29.95** MFJ-1286

Snag rare DX for only $29.95! The MFJ-1286 is a computerized DXing tool that predicts DX propagation. Even the casual DXer can work rare DX by knowing when conditions are best for DX. The Gray Line is the day/night divider line where the most amazing DX happens every day. Now you'll know **exactly** when to take advantage of it.

Gives detailed world map. Shows Gray Line for any date/time, UTC in 24 user chosen QTHs, time zones and more. IBM compatible. Any graphics.

MFJ's Speaker/Mics

For Kenwood, Icom, Yaesu, Santec

MFJ-284 or MFJ-286 **$24.95**

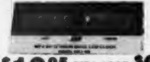
MFJ's compact Speaker/Mics let you carry your HT on your belt and never have to remove it to monitor calls or talk.

You get a wide range speaker and first-rate electret mic element for superb audio on **both** transmit and receive.

Earphone jack, handy lapel/pocket clip, PTT, lightweight retractable cord. Gray. One year **unconditional** guarantee.

MFJ-284 fits Icom, Yaesu, Santec. **MFJ-286** fits Kenwood.

12/24 Hour LCD Clocks



$19.95 MFJ-108B **$9.95** MFJ-107B

Huge 5/8 inch bold LCD digits let you see the correct time from anywhere in your shack. Choose from the dual clock that has separate UTC/local time display or the single 24 hour ham clock.

Mounted in a brushed aluminum frame. Easy to set. The world's most popular ham clocks for accurate logs. MFJ-108B 4½x1x2; MFJ-107B 2¼x1x2.

Lighted Cross/Needle SWR/Wattmeter

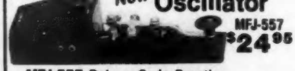
MFJ-815 **$69.95**

MFJ Cross-Needle SWR/Wattmeter shows you SWR, forward and reflected power in 3 ranges /200/ 2000 watts forward /50/500 reflected). Push button range selection. 1.8-30 MHz.

Mechanical zero adjust for movement. SO-239 connectors. Light requires 12 VDC or 110 VAC with MFJ-1312, $9.95.

Deluxe Code Practice Oscillator

New



MFJ-557 **$24.95**

MFJ-557 Deluxe Code Practice Oscillator has a Morse key and oscillator unit mounted together on a heavy steel base so it stays put on your table. Also portable because it runs on a 9 volt battery (not included) or an AC adapter that plugs into the side.

Earphone jack for private practice. Tone and volume controls for a wide range of sound. Speaker. The key has adjustable contacts and can be hooked to your transmitter. Sturdy. 8½x2¼x3¾ in. One year **unconditional** guarantee.

MFJ AC Voltage Monitor

$19.95 MFJ-850 New

Prevent damage to rig, computer or other gear. Monitor AC line voltage for potentially damaging surge/brown out conditions on 2-color expanded 95-135 volt scale.

Plugs into any AC outlet. 2% accuracy. 2¼x2¼x1½ inches.

• One year **unconditional** guarantee • 30 day **money back** guarantee (less s/h) on orders from MFJ • Add $5.00 each s/h • **Free** catalog

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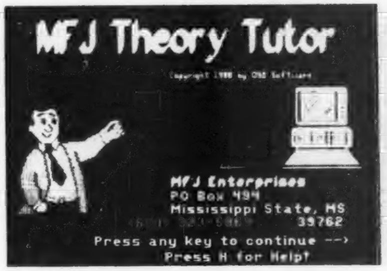
MFJ's *new* ham license upgrade Theory Tutor

get your ham license for only $29.95 with MFJ Theory Tutor! This fun new software practically guarantees you'll pass the theory part of any FCC ham license exam!



MFJ Theory Tutor

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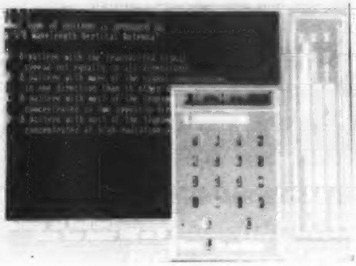
PO Box 494
Mississippi State, MS
(601) 323-5869 39762

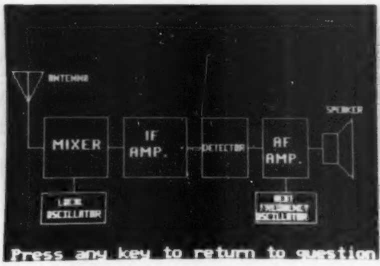
Press any key to continue -->
Press H for Help?

Here is the opening screen of MFJ's Theory Tutor -- a friendly, fun ***and*** *effective computerized teacher that gives you the edge you need to pass your next FCC ham license exam. A great gift for the budding Novice!*



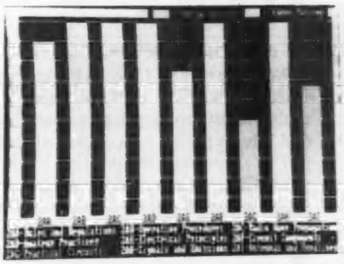
An easy-to-use on-line calculator is ready to help you when needed. Calculators are allowed in FCC testing sessions. To the right is the bar graph display that keeps up with your score as you go along.

You can change the screen colors with the Utilities menu. This lets you easily select the colors that make the MFJ Theory Tutor most pleasing on ***your*** *computer screen.*



Press any key to return to question

All test diagrams and figures are included for color graphics in MFJ's Theory Tutor. One key switches you between the question and the diagram on the left. After you have studied the picture, you can go back and answer the question. These easy-to-read computer graphics are the same ones used on the tests.



Here is the detailed score bar graph screen that you can bring up during a study session or at the end. It gives you a graphic display of your score in each exam category.

- ***Concentrate on any specific area or on the entire FCC question pool***
- ***Take sample tests or print written tests***
- ***All FCC test graphics and diagrams are included with appropriate questions***
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Welcome, Newcomers!

[Words in bold face are those you will encounter frequently in the features in this issue, and in packet radio in general. . . . Eds.]

Welcome to the *73* Special Packet Issue, in which you will find nearly 40 pages devoted to the fastest growing aspect in amateur radio! What is **packet** radio? Like radioteletype (RTTY), amateur teleprinting over radio (AMTOR), and even Morse code (CW), packet is **digital** communications rather than voice communications. With packet radio, you can transmit any form of information that can be represented as digital (on/off or discrete values) information. A typical packet station contains only three items—a transceiver, a computer or terminal, and an interfacing device, usually called a **Terminal Node Controller** (TNC) or data controller, which links the rig and computer.

Features Unique to Packet

Packet radio works by collecting information and then transmitting it in bursts or packets. Each packet contains a special **error detecting code** that allows the receiver to determine whether or not the packet was damaged or changed in transit. Damaged packets are discarded by the receiver, and the sender then retransmits another copy of the packet. Each packet contains a source and destination callsign so that only the intended recipient will process the packet. This allows several packet "conversations" to go on at the same time on the same frequency.

The procedure followed by both the sender and receiver to ensure the transmission of information is called a **protocol**. The most popular protocol used in amateur packet radio is called **AX.25** because it is based on the worldwide computer networking protocol X.25.

Networking—Packet Radio's Newest Feature

Networking is a way of connecting computers together so that they can communicate efficiently. To simplify understanding of networking, its features are broken down into component levels or layers, each with its own general function.

Why use layers? Well, imagine that you are trying to understand how a car works. You probably will study individually the parts of the car—the engine, the transmission, the suspension, the electrical system, and so on. When you understand the function and features of each, you can more easily understand how it all fits together to form a car. Understanding the layers of a computer network works the same way; if you understand the functions of each layer, you can better understand the function of the entire network.

Much study went into defining the component parts of a network. The result is a scheme composed of seven components or layers.

These layers are named **physical**, **link**, **network**, **transport**, **session**, **presentation**, and **application**. The physical layer describes the way to move the raw data from one point to another and includes descriptions of such items as voltages, connectors, signal frequency, and the like. The physical layer in amateur packet radio typically uses narrowband frequency modulation (**NBFM**) radios to carry the signal. The digital data, the binary ones and zeros, are fed into a device called a **modem**, which converts the digital information into a signal that can be sent over the radio. The modem on the receiving end converts the signal back into the original digital signal for processing. The AX.25 link layer ensures that any errors that occur during the transfer process are corrected.

Packet communications works best when the physical link is good (very few errors) and AX.25 doesn't have much to do. Several articles in this issue deal with ways to physically transmit information faster, farther, and with fewer errors.

See the article "Amateur Radio Networking" in this issue for a fuller description of the network layers.

Until recently, packet radio was pretty much limited to point-to-point communications. There really wasn't a network layer to route the data to a distant station via intermediary stations. Neither was there a good transport layer to ensure that the message, when it reached the final destination, was accurate. There was no session layer to keep multiple activities (for example, a keyboard-to-screen chat and a file transfer) separated, and no presentation layer to hide the differences between computer systems.

Times have certainly changed. Now there is the Transmission Control Protocol/Internet Protocol (**TCP/IP**), the RATS Open System Environment (**ROSE**), TexNet, and **NET/ROM**. Each of these networking systems offers a different mechanism for moving packet information long distances.

Once there is a way of moving digital information long distances reliably, there is a desire to use that resource. Something that uses the network is called an **application**. The most common application (and up until now just about the only application) in packet radio is the bulletin board system (**BBS**). A BBS is a computer program that lets you use packet radio to send and receive electronic mail and bulletin messages. New applications are beginning to appear that permit someone to query about another ham, send or receive a computer program, or perhaps let your computer use the resources of a remote computer system.

Higher speeds, more reliable links, and better networking protocols will give rise to new applications. The 56,000 bit per second modem described by Phil Karn in this issue will make the computer-to-computer link comfortable. The 1,500,000 bit per second microwave packet system shown on the cover will make digital voice and digital amateur television possible. The bottom line is that packet radio is going to eventually affect every aspect of amateur radio, from chasing DX to providing better public and emergency communications service.

Now is the time for you to get involved with amateur packet radio. You can use it right now as an everyday aspect of your communications and you can get involved in experimentation and advancing the state-of-the-art. Either way, you will be challenged and delighted by this diverse and interesting facet of the exciting hobby of amateur radio.

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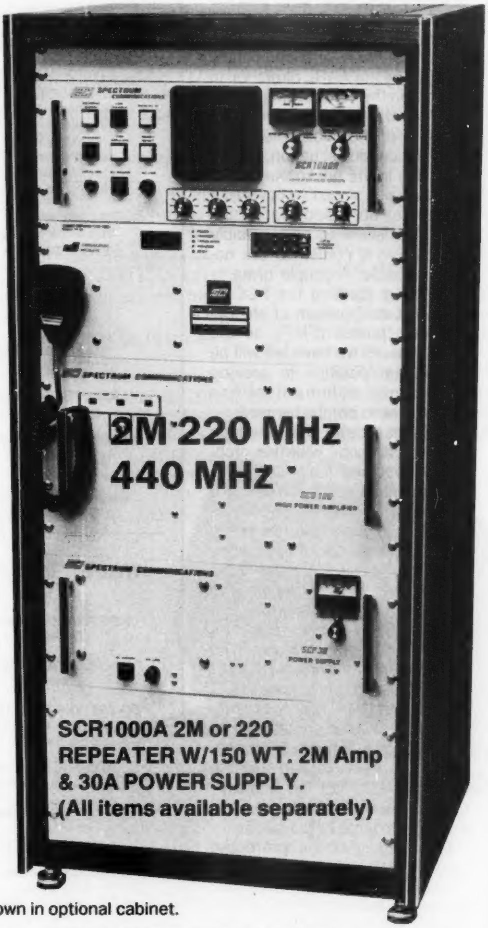
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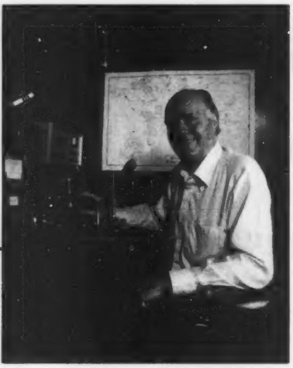


EMP Revisited

Seven years ago the FCC's Defense Commissioner, Mimi Dawson, with the support of Chairman Mark Fowler and Senator Goldwater, formed the Long Range Planning Committee (LRPC) with four National Industry Advisory Committees (NIAC) to assist it. The LRPC was made up of top executives in the communications industry, brought together to formulate an overall plan for emergency communications for our country.

The first step was to see what had been done in the past to cope with emergencies—what systems were available and how they had worked. The next step was to look closely at all communications systems and their role in helping us cope with future emergencies. Emergencies encompassed everything from local problems due to accidents, fires and floods, to regional emergencies due to earthquakes, right on up to the ultimate emergency: an atomic attack.

The LRPC soon had to face one fundamental fact: Only the amateur radio service had the potential for providing the needed communications. The military depended almost entirely on commercial telephone lines for their communications (95%)—and the first thing which seems to go out in any emergency is the telephone. Indeed, it was this which put the Alaskan military bases out of communications with the Pentagon for almost a week following the Alaskan earthquake. Their only communications were via hastily set up amateur radio networks.

The LRPC and the FCC then faced an extremely serious problem. If the only dependable emergency communications system which could tie together police, fire, towns, road crews, two-way services such as trucks, taxis and doctors, television remote units, CB, CAP, MARS, broadcast radio and TV, and so on, was amateur radio, then we were going to need a substantial growth and modernization of this service. The traffic volumes estimated were several orders of magnitude beyond the capability of our present voice or CW communications systems. These volumes could only be handled by high speed automated digital communications, such as packet radio.

The LRPC and the Commission then tried to tackle the need for vastly more hams. The only ham system in the world which seemed to be working these days was the one adopted by the Japanese—a no-code license. Efforts to implement this here were completely stopped by the ARRL directors. In frustration the FCC disbanded the LRPC and its NIAC committees, giving up on the whole emergency communications situation.

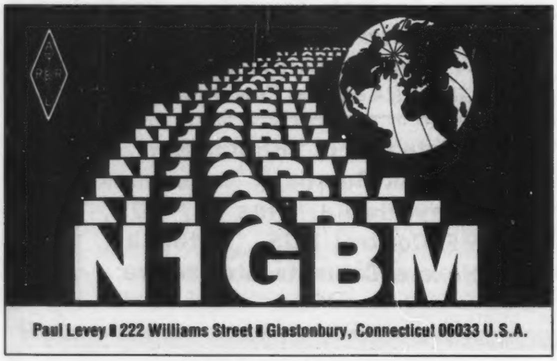
All this is the background and, my apologies since I've covered it all before, but I find many ham memories seem to be incredibly short when it comes to the no-code debacle. A couple of hams have been pushing the FCC to deal with the problem of electromagnetic pulses (EMP), so the few amateurs we have left will be in a better position to provide emergency communications should atomic bombs be used.

Little has been published on how we can cope with this problem. Indeed, we have little information on how much of a problem this really is! Some reports indicate that a high altitude bomb might wipe out most solid state equipment for a thousand miles around. Pffft would go all our HTs and mobile VHF gear—plus our low-band rigs—leaving us nothing with which to communicate. The Department of Defense (DOD) has been fighting to keep the FCC out of the EMP arena, saying there's plenty of information available on how to guard against EMP. The hams replied that the key information on this is classified—or, at best, apparently only available to large corporations.

Can ham gear be protected against EMP so we would have a chance to do our thing in case of an atomic bomb? Unless data is made available to help us shield and protect our ham stations, and to help manufacturers build in bypassing and shielding, the only backup communications our country has in case of such an emergency will be completely out of business.

Well, you say, the likelihood of an atomic attack is remote enough so all that is just the usual gloom and doom baloney. That's nothing I have to worry about any

Continued on page 74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- **Multi-function DTMF mic. supplied.** Controls are provided on the microphone for CALL (Call Channel), VFO, MR (Memory Call or to change the memory channel) and a programmable function key. The programmable key can be used to control one of the following on the radio: MHz, T. ALT. TONE, REV, DRS, LOW or MONITOR.
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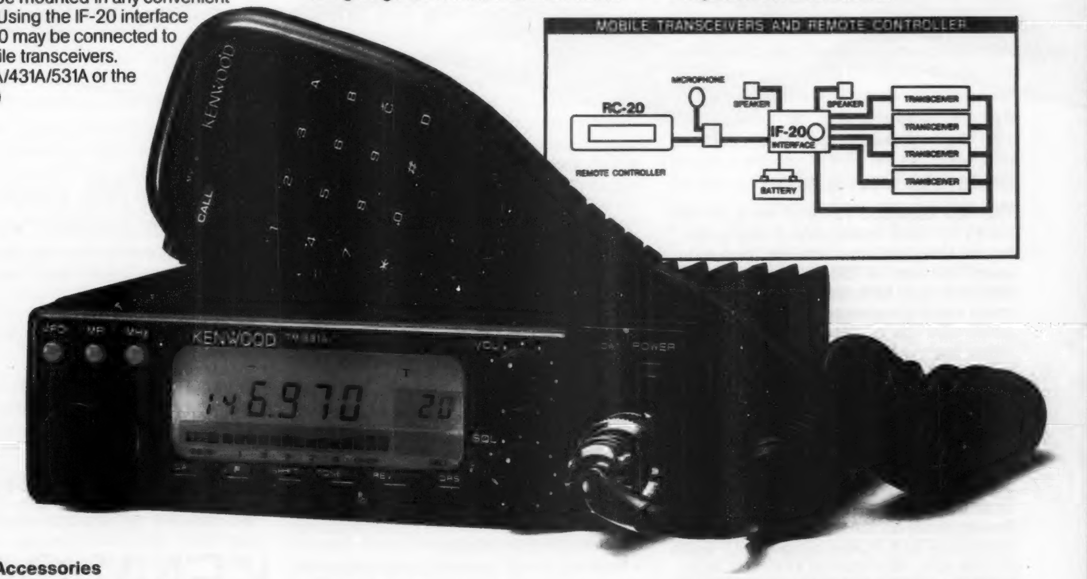

Optional Accessories

- **RC-20** Full-function remote controller
- **RC-10** Multi-function remote controller
- **IF-20** Interface unit handset • **DRU-1** Digital recording unit • **MC-44** Multi-function hand mic. • **MC-44DM** Multi-function hand mic. with auto-patch • **MC-48B** 16-key DTMF hand mic. • **MC-55** 8-pin mobile mic.
- **MC-60A/80/85** Desk-top mics. • **MA-700** Dual band (2m/70cm) mobile antenna (mount not supplied) • **SP-41** Compact mobile speaker • **SP-50B** Mobile speaker • **PS-430** Power supply • **PS-50** Heavy-duty power supply • **MB-201** Mobile mount • **PG-2N** Power cable • **PG-3B** DC line noise filter
- **PG-4H** Interface connecting cable • **PG-4J** Extension cable kit • **TSU-6** CTCSS unit

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TS-790A

Satellite Transceiver

The new Kenwood TS-790A VHF/UHF all-mode tri-band transceiver is designed for the VHF/UHF and satellite "power user." The new TS-790A is an all-mode 144/450/1200 MHz transceiver with many special enhancements such as automatic uplink/downlink tracking. Other features include dual receive, automatic mode selection, automatic repeater offset selection for FM repeater use, VFO or quick step channel tuning, direct keyboard frequency entry, 59 memory channels (10 channels for separate receive and transmit frequency storage), multiple scanning and multiple scan stop modes. The Automatic Lock Tuning (ALT) on 1200 MHz eliminates frequency drift. Power output is 45 watts on 144 MHz, 40 watts on 450 MHz, and 10 watts on 1200 MHz. (The 1200 MHz section is an optional module.)

- **High stability VFO.** The dual digital VFOs feature rock-stable TCXO (temperature compensated crystal oscillator) circuitry, with frequency stability of ±3 ppm.
- **Operates on 13.8 VDC.** Perfect for mountain-top DXpeditions!
- **The mode switches confirm USB, LSB, CW, or FM selection with Morse Code.**
- **Dual Watch allows reception of two bands at the same time.**
- **Automatic mode and automatic repeater offset selection.**
- **Direct keyboard frequency entry.**
- **59 multi-function memory channels.** Store frequency, mode, tone information, offset, and quick step function. Ten memory channels for "odd split."
- **CTCSS encoder built-in.** Optional TSU-5 enables sub-tone decode.
- **Memory scroll function.** This feature allows you to check memory contents without changing the VFO frequency.
- **Multiple scanning functions.** Memory channel lock-out is also provided.
- **ALT—Automatic Lock Tuning—on 1200 MHz eliminates drift!**
- **500 Hz CW filter built-in.**
- **Packet radio connector.**
- **Interference reduction controls:** 10 dB RF attenuator on 2m, noise blanker, IF shift, selectable AGC, all mode squelch.
- **Other useful controls:** RF power output control, speech processor, dual muting, frequency lock switch, RIT.
- **Voice synthesizer option.**
- **Computer control option.**

Optional Accessories:
- **PS-31** Power supply • **SP-31** External speaker • **UT-10** 1200 MHz module • **VS-2** Voice synthesizer unit • **TSU-5** Programmable CTCSS decoder • **IF-232C** Computer interface • **MC-60A/MC-80/MC-85** Desk mics • **HS-5/HS-6** Headphones • **MC-43S** Hand mic • **PG-2S** Extra DC cable

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QRX . . .

EDITED BY BRYAN HASTINGS NS1B

Kudos

. . . to Brian Lloyd WB6RQN, for coordinating this month's Special Packet Issue, and especially for his editorial contributions. His efforts in gathering the editorial material were key to the formation of this issue. Thanks very much, Brian!

Home-Brew IV Contest Results

The verdict is in for the top three articles for the Home-Brew IV contest! The four-member evaluation panel, consisting of Jeff DeTray NK1F, Perry Donham KW1O, Bryan Hastings NS1B, and Walter Lewandowski WA2VSN, spent many hours in late July carefully reviewing each candidate. The decisions were tough, as there were many fine entries from which to choose.

First prize went to Michael Geier KB1UM, for "Flavorig!", his inexpensive and simple conversion of a Radio Shack Flavoradio™ transistor AM radio to a 5 watt 80m CW transceiver. The second prize went to Ron Cole K4OND for the "Bitchaser," a totally home-brew comprehensive piece of test gear designed especially for digital circuitry. Third prize went to William Lazure KB5CTH for his elegant version of a stable sensitive 60 Hz–100 kHz frequency meter.

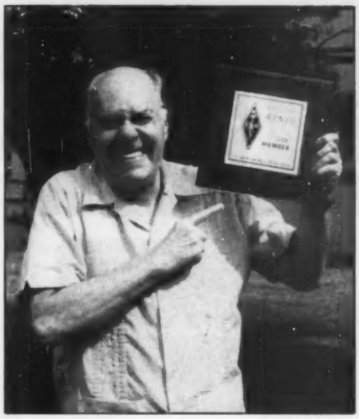
These top three articles will appear in the November 1989 issue. Thanks to all who participated! For those of you who didn't make it, be sure to look out for the announcement for the Home-Brew V contest in 1990.

Shockley SK

William Shockley, co-inventor of the transistor and Nobel Prize winner whose later life became embroiled in controversy over his racial theories, died of cancer at his home in Stanford, California. He was 79 years old.

Shockley shared the Nobel Prize for physics in 1956 with his colleagues from Bell Laboratories, John Bardeen and the late Walter H. Brattain. The team's first semiconductor device, developed in 1947, was an innovation that made the electronic age possible. Shockley Semiconductor Co., the company he founded after leaving Bell labs in 1954, was instrumental in the birth of the Silicon Valley electronics industry. His former employees later invented the integrated circuit and the microprocessor.

Shockley's later life was marked by bitter controversy over his claims that intelligence was genetically determined, and that blacks were genetically inferior and as a group could not be as bright as whites. His claims contributed to debate over the use of IQ tests in schools and over why black Americans failed to score as well as whites, an outcome most experts blamed on biased tests and other factors not related to genetics.



Guess who's a 50-year member of the League? Wayne W2NSD/1, "shows off" his plaque from the ARRL . . .

ARRL Pro No-Code

The ARRL is getting with the program at long last! Their Board of Directors ruled in favor of adopting a no-code license class. On 21–22 July, after an extensive and sometimes heated discussion, and by a vote of nine Directors in favor to six opposed, they agreed that the ARRL will present a proposal recommending a codeless class of amateur license to the FCC. This proposal for the new class of license—to be called "Communicator"—will be in the form of a petition for rulemaking.

The examination will consist of Novice-written Element 2 and an expanded Technician-written Element 3A having additional questions. These will include questions related to Morse Code.

All license examinations will be given through the VEC examination system. To upgrade to Technician, the new licensee must pass a five-word-per-minute Morse code test also administered through the VEC system.

Callsigns will be assigned from the Group D callsign block. Frequency privileges will be 220 MHz and above, with output power limited to 250 watts. The no-code licensee will not be allowed to be the control operator of a repeater or auxiliary station.

JA WARC Bands

Japan's amateurs now have full access to the 18 and 24 MHz WARC bands. In 1979, the ITU created three new ham bands at 10, 18, and 24 MHz. In 1982, Japanese amateurs were granted privileges on 10 MHz, but it was not until 1 July that the other two bands were opened to them. The 18 MHz band is restricted to Japanese First and Second Class license holders, but 24 MHz is open to all operators.

Put This In Your Pipe

A California ham is suing General Telephone due to their alleged discrimination against non-smokers. Craig Chambers WB6HTS of Los Angeles is making national headlines after filing suit against the giant telecommunications conglomerate. According to Chambers, not only was his request to be placed in a non-smoking environment denied, but he soon found himself called on the carpet by his superiors. He claims he was fired from his job after requesting a medical transfer to keep him away from tobacco smoke.

Let's hope hams and non-hams alike appreciate Craig's fight for the right to work in an environment that is free of tobacco smoke. Send letters of support to Craig Chambers, 2829 Warwood Rd., Lakewood CA 90712.

UK Murder

A ham and his wife have been murdered in England, and the police are asking hams to aid them in finding the killer. Peter Dixon G0HFQ and his wife Gwenda were last seen on Thursday, 29 June when they left on a camping trip to Howstone Farm near Little Haven in Pembrokeshire. Their bodies were discovered on 5 July. Both died of gunshot wounds and investigators say that they were killed within a half mile of their campsight. Dixon's car was equipped with both HF and VHF amateur gear. Police are asking any ham, anywhere in the world, that may have contacted G0HFQ between 29 June and 5 July to get in touch with them. Contact the Murder Incident Room of the Pembrokeshire Police at Haverfordwest 3721. The STD code is 0437. If you are calling from outside the United Kingdom, request operator assistance.

Merci Beaucoup

Thanks to *Westlink Report, RF Carrier*, and Associated Press for providing items for this month's QRX. Keep your ham radio-related news items and photos rolling in to *73 Magazine,* WGE Center, Forest Rd., Hancock NH 03449, Attn: QRX. You may also submit text as E-Mail to the Sysop on the the 73 BBS, (603) 525-4438, 300/1200 baud, 8 data bits, no parity, and one stop bit.

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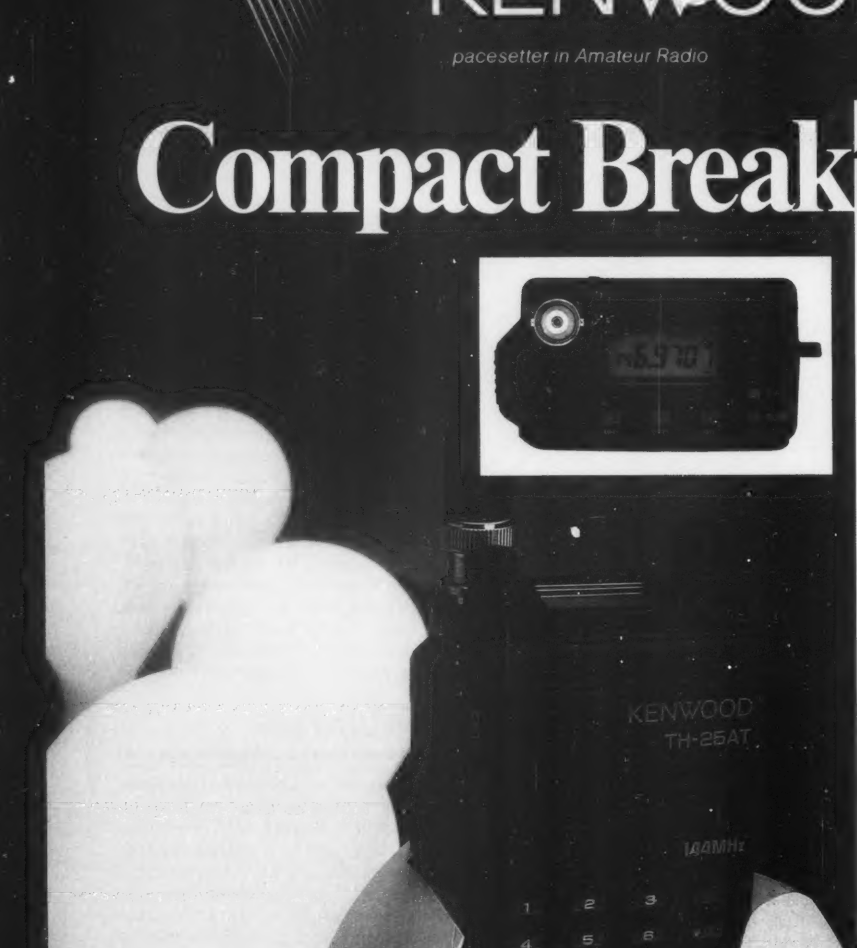

The all-new TH-25 Series of pocket transceivers is here! Wide-band frequency coverage, LCD display, 5 watt option, plus...

- Frequency coverage: **TH-25AT:** 141-163 MHz (Rx); 144-148 MHz (Tx). (Modifiable for MARS/CAP. Permits required.) **TH-45AT:** 438-450 MHz.
- Automatic Power Control (APC) circuit for reliable RF output and final protection.
- 14 memories; two for **any** "odd split" (5 kHz steps).
- Automatic offset selection (TH-25AT).
- 5 Watts from 12 VDC or PB-8 battery pack.
- Large multi-function LCD display.
- Rotary dial selects memory, frequency, CTCSS and scan direction.
- T-ALERT for quiet monitoring. Tone Alert beeps when squelch is opened.
- Band scan and memory scan.
- Automatic "power off" circuit.
- Water resistant.
- CTCSS encoder/decoder optional (TSU-6).
- **Supplied accessories:** StubbyDuk, PB-6 battery pack for 2.5 watts output, wall charger, belt hook, wrist strap, water resistant dust caps.

Optional accessories:
• **PB-5** 7.2 V, 200 mAh NiCd pack for 2.5 W output • **PB-6** 7.2 V, 600 mAh NiCd pack • **PB-7** 7.2 V, 1100 mAh NiCd pack • **PB-8** 12 V, 600 mAh NiCd for 5 W output • **PB-9** 7.2 V, 600 mAh NiCd with built-in charger • **BC-10** Compact charger • **BC-11** Rapid charger • **BT-6** AAA battery case • **DC-1/PG-2V** DC adapter • **HMC-2** Headset with VOX and PTT • **SC-14, 15, 16** Soft cases • **SMC-30/31** Speaker mics. • **TSU-6** CTCSS decode unit • **WR-1** Water resistant bag

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Packet Racket Lip Zipper

Automatically turns off your rig's speaker during packet operation.

by Michael J. Geier KB1UM

If you're like most of us frugal hams, you're using your 2 meter base rig for both voice and packet—and you're sick and tired of the awful packet screech and having to connect and disconnect cables every time you switch modes! Of course, you can solve these problems by buying another rig for packet, but why spend $500 when you can build the Packet Racket Lip Zipper for next to nothing?

The Lip Zipper switches the audio output of your rig from an external speaker (or even the internal one, if an interrupting connector is provided on the radio) to the audio input of your TNC. In addition, you can use it to switch the rig's mike input between the mike and the TNC.

A glance at Figure 1 reveals how simple the Lip Zipper is. It takes its power from the 12V supply powering the rig and/or TNC, drawing minimal current. It senses activation of the TNC from pin 9 of the DB-25 serial connector, then energizes the relay. (Pin 9 on my MFJ 1270 TNC is connected to +12 volts. If yours isn't, try using pin 6, the Data Set Ready connection. Anything that switches on and off with the TNC will do.) You can make the whole circuit from Radio Shack parts, and it will fit into a plastic 35mm film can or other handy container (see photo).

Construction

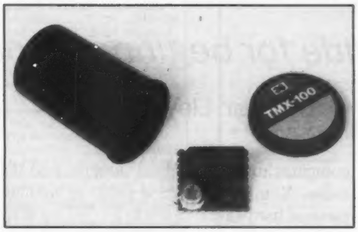
Use any construction technique you like. Nothing is critical here, although I do recommend shielded cable for all audio leads, including the speaker connections. Otherwise, RF hash from your computer can get into the TNC and cause problems. Of course, that can happen even without the Lip Zipper.

First, connect the sense wire to pin 9 (or 6) of the DB-25 on the back of your TNC. If you have a sealed, factory-made cable, you'll have to open its connector far enough to connect the wire. If that seems too difficult, you can open the TNC and connect to the PC board, running the wire out the back. But you'll void your warranty if you do it that way.

Connections to your radio will depend on its make and model. Some rigs, like my trusty old KDK FM-2016A, have an accessory plug on the back that lets you interrupt the audio going to the internal speaker. If yours doesn't, you'll have to use an external speaker. Many base station ops do that anyway, for the better sound.

Lip Zipper Parts List

Q1	2N2222	RS# 276-2009
Q2	2N3053	RS# 276-2030
D1	1N4003	RS# 276-1102
K1	DPDT	RS# 275-249
R1	100k	



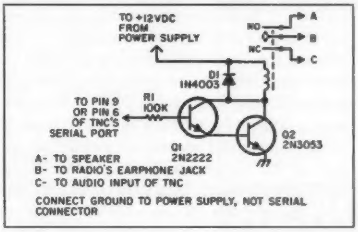

TO +12VDC FROM POWER SUPPLY
NO
NC
A
B
C
D1 1N4003
R1 100K
TO PIN 9 OR PIN 6 OF TNC'S SERIAL PORT
Q1 2N2222
Q2 2N3053
A- TO SPEAKER
B- TO RADIO'S EARPHONE JACK
C- TO AUDIO INPUT OF TNC
CONNECT GROUND TO POWER SUPPLY, NOT SERIAL CONNECTOR

Figure 1. Schematic for the Packet Racket Lip Zipper.

When you're done, stuff the board into the container and put it out of sight. Since it has no user controls, you don't need it cluttering up the shack!

An Option

My accessory plug also has an audio input pin, originally intended for a DTMF pad. I connected it to the audio output of my TNC and it worked fine. It doesn't seem to mind that the mike is still connected, but if yours does, just use the optional circuit shown in Figure 2.

These extra connections let you switch the rig's mike input between the mike and the TNC, and they require you to get into your mike plug and add some wiring. Be sure to use shielded cable; the old "twisted pair" just won't do.

Powering Up

With the Lip Zipper installed, turn on your 2 meter rig, leaving the TNC off. Your mike and speaker should operate normally. Now fire up the TNC. The speaker should quiet immediately, and if you're using the optional circuitry, the mike should no longer work (although the PTT will still key the rig).

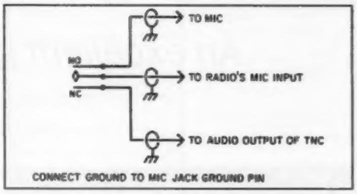


Figure 2. Optional circuit for switching between mike and TNC.

Sit back and enjoy the quiet and convenience of a dedicated packet station. When you're ready to return to voice operation, just switch the TNC off and you're back on the air! ■

Michael J. Geier KB1UM appears monthly as 73's Tech Answer Man in "Ask Kaboom." You can contact him at 7 Simpson Court, S. Burlington VT 05403.

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Setting Up a Packet Radio Station

An excellent guide for beginners and veterans alike.

by Brian Lloyd WB6RQN

You may be just joining the packet radio revolution or you may have been using packet for a while. Either way, this step-by-step guide to setting up a working, reliable packet station is here to help you. You beginners, and those of you just getting interested, will find simple advice that's unavailable in any book. Those of you who are experienced packeteers will learn how to gauge the performance of your radio when you use it as part of your packet station.

What System to Put Together?

There are just a few components to the basic system—the transceiver, the terminal (or personal computer), and the Terminal Node Controller (TNC) or data controller. The TNC "interfaces" the rig and the PC—that is, it goes in-line between the two. The following few sections discusses these three components.

#1 - The TNC/Data Controller

Until a few years ago, the only interface was the TNC. Most TNCs contain two devices, a modem (MOdulator/DEModulator) and a packet assembler/disassembler (PAD). A modem is a device that converts the digital pulses from the computer to a form the radio can use to modulate a carrier wave, and vice versa. The PAD converts the data stream coming from the computer into discrete groups—called "packets"—which go on to the transmitter. It also converts the packets arriving from the receiver into a continuous data stream that goes on to the PC, which interprets the data as text and prints it onto the monitor.

Nowadays there's a little more selection. In the last few years, data controllers—devices that can encode/decode other digital modes such as RTTY, AMTOR, and CW in addition to packet, appeared on the market. These are also called multimode or all-mode controllers. Examples of these are the AEA PK-232, the MFJ 1278, and the Kantronics KAM. You just put them in in place of the TNC.

Even newer to the market are boards that plug into your computer to make it a complete packet radio system, except the transceiver. (See the review of the DRSI Packet Adapter in this issue.) The plug-in board approach is pretty much limited to the IBM-PC and compatible computer systems. Most of the plug-in boards offer an on-board modem so that the computer may be plugged directly into the radio. You won't need a cable or another piece of hardware.

If you plan to get into packet very seriously and/or are an avid experimenter, the plug-in board is probably the best way to go. It can also be the least expensive since many of these boards give you connections for two radios (it's like having two TNCs). The software available for the plug-in boards tends to be more powerful because it can take advantage of the computing power of the PC—a much more powerful computer than the TNC or data controller. If you want to operate on HF and you have chosen the plug-in board approach, don't worry; many vendors offer external modems optimized for HF operation, which you can attach to one of the serial ports on the plug-in card.

If you are interested in operating packet and you want to operate RTTY, CW, and/or AMTOR, choose a multimode device. They provide all the modes of operation and usually include a special modem and tuning indicator that is optimized for HF operation. When you select packet operation in any of the multimode devices they perform as ordinary TNCs.

If, like most packeteers, you plan to use packet on VHF for local communications, the TNC is your best bet. This is the traditional way to construct a station and, in many cases, is also the least expensive way to go.

#2 - The Transceiver

For VHF operation most packeteers use a standard VHF NBFM radio. Since most packet operation takes place on only a few frequencies, an old crystal-controlled rig is a good choice. On 2 meters, much of the packet activity goes on between 145.01 and 145.11 MHz.

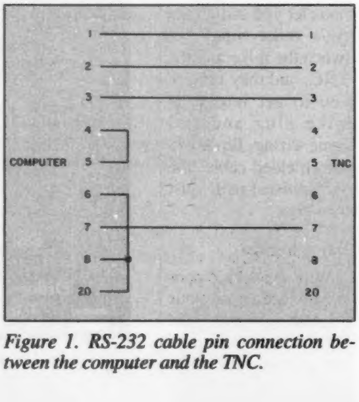

Figure 1. RS-232 cable pin connection between the computer and the TNC.

Consider also transmitter power. Packets need a good signal-to-noise ratio to get through reliably. It really doesn't hurt to have a 25W transmitter. A handy-talkie may be convenient but its 2W output can make a link marginal.

On the same token, it's especially important in packet radio to have a good receiver and antenna. You should be able to hear those stations that hear you. This is because packet is a simplex mode—it operates on only one channel. Thus, a packet station listens on the channel and does not transmit until it senses that the channel is clear. If two or more packet stations transmitted on the same channel simultaneously, then those packets would "collide," causing their corruption. For packet to work well it is important to hear all the other packet stations in your area. If your system can't hear another station, it may think the channel's clear when it may actually be busy, and so transmit, causing a collision.

Effective HF packet operation requires a very stable rig that can be tuned within 20 Hz of the desired operating frequency. If you have an analog rig, consider crystal control for the frequencies you plan to use. (HF packet tends to operate on just a few frequencies). If you have one of the newer digital rigs that use a PLL for frequency control, consider getting the high accuracy option (usually a temperature-compensated crystal oscillator or a crystal oven).

You want also to have a good 500 Hz bandwidth receiving filter. Filters in the modem are no substitute for a good crystal or mechanical filter in the receiver's IF. For best performance, AGC sampling must take place AFTER the selectivity, not before. If you use a wide filter, an unwanted signal in the receiver's passband can cause a change in the receiver's AGC even though the signal doesn't otherwise interfere with the packet signal you are trying to receive. The gain change can confuse the modem and make the packets unreadable.

Packet, like AMTOR, likes a fast transmit/receive switching time on the radio. The receiver must recover very quickly after transmitting so you can reliably receive the acknowledgments from the other station. Although a slow transceiver can be made to

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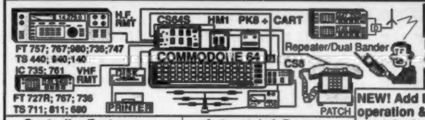

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work, it requires both stations to make adjustments in the transmitter keyup delay value (TXDELAY) in the TNC. (See the discussion on setting TXDELAY later in this article).

#3 - The Computer or Terminal

If you acquire a TNC you need a computer or a computer terminal to display the data. If you choose to use a computer terminal it should be capable of asynchronous ASCII operation. A terminal usually has everything you need to communicate with the TNC built-in, so all you need to connect the terminal to the TNC is a cable (see below).

Computers are inherently dumb and must be told what to do by software programs. If you are operating with a multimode device or a TNC you need a program for the computer that allows it to operate as a terminal. Most vendors of TNCs and multimode devices offer programs for the more popular computers. These programs are tailored to packet operation and include features that make operating packet radio more efficient, simple, and enjoyable. On the other hand, almost any program designed to allow the computer to operate with a modem—such as Crosstalk or Procomm—works fine.

If you get the add-in board you'll need some special software. This software should come with the board, usually in the form of one or more computer diskettes. Some boards have publicly-available software.

Connecting the TNC to the Computer

If you choose the add-in board approach, the connection is handled internally in the computer. The manufacturer's instructions tell you how to properly configure the jumpers or switches on the board.

If, however, you have a TNC or multimode controller, obtain a cable to connect the device to your computer or terminal. In order for your personal computer to "talk" to a TNC, make sure that it has true asynchronous RS-232 serial port. (Some less expensive computers do not adhere to RS-232 signal level specs. These computers may not work well with some types of TNC.) A serial port is one that accepts digital data serially—that is, one bit at a time. Most serial port connectors on computers are either DB-25 males or DB-9 females. Then buy or configure an RS-232 cable with the appropriate connectors.

Some computers, such as the ever-popular Commodore-64 and the VIC-20, have TTL signal levels at their serial ports. You have several options here: find a TTL/RS-232 level converter interface, or get a TNC/data controller that uses TTL signal levels rather than RS-232.

The simplest cable for connecting the TNC to the terminal requires only three signals: transmit data, receive data, and ground. On a standard DB-25 RS-232 connector these are pins 2, 3, and 7, respectively. Try the "three wire" connection first to see if it works. Connect the TNC to the terminal, turn on the terminal, then turn on the TNC. Something should appear on the screen (although it may be random "garbage" characters). If you get absolutely nothing on the screen, your terminal or computer probably requires some of the RS-232 control signals in addition to the transmit and receive data signals. Try connecting the signals "Data Set Ready" (pin 6), "Data Carrier Detect" (pin 8), and "Data Terminal Ready" (pin 20) together at the terminal/computer end of the cable. You should now get something on the screen when you turn on the TNC.

The next step is to ensure that the computer/terminal and the TNC are sending data to each other at the same speed (baud rate) and format. Most packeteers use 4800 or 9600 bauds between the TNC and the terminal with 8 data bits, no parity, and one stop bit. Set the terminal or your terminal program to the desired baud rate and these parameters. Some TNCs have a switch on the back that lets you set the data rate. In that case, set the baud rate on the TNC to the desired value.

Some TNCs have no external switch for baud rate. These TNCs have an autobaud routine that automatically determines the baud rate used by the terminal. Usually you wait until a legible message from the TNC appears on the screen of your terminal, then you press a specific key on the keyboard. At this point there should be communications between the TNC and the terminal in both directions.

Sometimes your terminal can see what the TNC is sending but the TNC appears to ignore everything you type. This is usually a problem with the RS-232 connection. If this occurs, try connecting the "Request To Send" signal (pin 4) to the "Clear To Send" signal (pin 5) at the terminal or computer RS-232 connection.

At this point the terminal and TNC should be communicating. If every character you type appears twice on the screen, set your terminal or computer for full-duplex operation.

This is a good time to set the terminal control parameters of the TNC. Every TNC or multimode controller has some preset or default values for its control characteristics. You can change these parameters to make the TNC more compatible with your terminal. If you are using a CRT terminal or a computer, enter the command BKONDEL ON. After this command the TNC erases characters on the screen when you press the backspace key on the keyboard. Some terminals generate the ASCII rubout (delete) code instead of the ASCII backspace code when the backspace key is pressed (DEC VT-100 and compatible terminals). You can tell that this is happening if you make a mistake then correct it with the backspace key, and the TNC does not recognize what appears to be a perfectly valid command. You can tell your TNC to recognize your backspace key with the commands DELETE $7F or DELETE ON. Read the manual that comes with your TNC to find the appropriate command.

Many terminals and terminal programs provide some sort of line wrapping function. This means that if you type beyond the end of a line your typing continues on the next line. The TNC also provides this feature. If both are turned on, you see text on every other line whenever the text extends beyond the end of the line. To prevent this, either turn off the line wrapping at the terminal or send the following command to the TNC: SCREENL 0.

This is the time to experiment with sending commands to your TNC. You can get a feeling for how it works before you hook it up to the radio.

Connecting the TNC to the Radio

Perhaps the single most important thing you can do to ensure reliable packet operation is to properly connect and adjust the TNC to the radio. First, decide where to connect the two. Many transmitters offer a high-level auxiliary input. Use this input instead of the microphone input if possible. Many microphone inputs do some equalization or signal processing that can distort the signal generated by the TNC thereby making it difficult for other stations to decode your packets. The signal at the aux input often bypasses these stages and provides better performance.

The audio from the receiver needs to get to the TNC. Although the signal from the speaker may work, it is almost always distorted by the audio amplifier. The result is that the TNC fails to decode otherwise good packets. Many radios offer a low-level audio output for a phone patch or selective calling unit. This low-level output is a much better choice than the speaker jack. If your radio does not offer a low-level output, try taking the signal from the "hot" side of the volume control.

Once you have the TNC connected to the radio, adjust the transmit signal level so that the signal from the TNC properly modulates the transmitter. Proper adjustment here is critical for good results. There are two techniques for setting the transmit level of an NBFM transmitter.

The first technique requires a deviation meter. Set up the deviation meter to read the deviation of the transmitted signal. Turn on the transmitter and the TNC and enter the calibration command. If your TNC offers the option of selecting either the high or low tone, select the high tone and adjust the signal level at the TNC for 2.5 to 3 kHz of deviation. If your calibration command alternates between the mark and space tones at a rapid rate (Kantronics' calibration command does this) set the level at the TNC for 2.0 to 2.5 kHz of deviation.

The second technique does not require a deviation meter but it does require a receiver and an AC voltmeter. Connect the voltmeter to the output of the second receiver so that you can get a relative indication of audio output. Set the frequency of the receiver to the output frequency of your TNC/radio pair. Turn on the transmitter and the TNC and enter calibration mode. Select the high tone and increase the TNC's transmit signal level until further increase of the level at the TNC no longer results in an increase in the level indicated by the AC voltmeter connected to the second receiver. Note the reading on the voltmeter. Now decrease the signal level at the TNC until the voltmeter connected to the

Continued on page 18

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Career Aims Shaped by Radio Theory

Elan Grossman KA2RMW, age 20, got his ham ticket at age 14, after enrolling in Carole Perry WB2MGP's course at Intermediate School 72 in Staten Island, New York. He is presently an undergraduate at Wesleyan University, majoring in both physics and astronomy. He just finished a research apprenticeship at Wesleyan's Van Vleck Observatory (which houses the largest telescope in Connecticut) working on a project to study physical properties of stars under formation and to search for possible planets around them. Elan also works with a 20-inch Alvan Clark refractor that records the apparent parallax shift in nearby stars, a way of determining their distances.

Elan Grossman KA2RMW—a young ham active in astrophysics.

Elan is also part of a project under grant to conduct research on a new form of radiation detector that would be able to measure the quantity of radiation to which a person has been exposed. He also taught gifted high school youth during the summer.

Elan's future plans include a Ph.D. in either astrophysics or planetary science. He says the knowledge he gained in radio theory played a significant role in shaping his interests in electrodynamics and radio astronomy.

Young Ham of the Year

Erin McGinnis KA0WTE, age 18, of Topeka, Kansas is this year's *Westlink Report* "Young Ham of the Year." This Tech licensee was chosen for this high honor because of her ongoing dedication to amateur radio public service activities, disaster preparedness work, and publicization of amateur radio. She regularly participates in civic events such as net control for the Washburn University President's Rowing Regatta, the Annual Railroad Days Commemorative, and the Exxodusters Parade. Erin also displays amateur radio at emergency preparedness exhibits, is a regular member of the local ARES operation, and participates in each Field Day.

Erin organized press releases and interviews for the local and the national electronic press, and assisted in the preparation of a city resolution declaring Field Day to be "Kaw Valley Amateur Radio Club Week" in Topeka. She also organizes and teaches the club's fall Novice training class.

Erin Mc Ginnis—Young Ham of the Year.

Erin is a recent Honor Roll graduate of Topeka High School where she maintained a straight "A" average during her Senior year. High school activities included dramatics, drill team, debate squad, various social functions and, of course, amateur radio. She also held a part-time job.

Erin comes from an all-ham family: Her father is Steve N0HGX, her mother is Linda N0HGY, and brother Matt is KA0WTF. Her primary ham interest is chatting with the British Isles. She intends to use amateur radio to keep in contact with her family from Emporia State College.

FEEDBACK

In our continuing effort to present the best in amateur radio features and columns, we recognize the need to go directly to the source—you, the reader. Articles and columns are assigned feedback numbers, which appear on each article/column and are also listed here. These numbers correspond to those on the feedback card opposite this page. On the card, please check the box which honestly represents your opinion of each article or column.

Do we really read the feedback cards? You bet! The results are tabulated each month, and the editors take a good, hard look at what you do and don't like. To show our appreciation, we draw one feedback card each month and award the lucky winner a free one-year subscription (or extension) to *73*.

To save on postage, why not fill out the Product Report card and the Feedback card and put them in an envelope? Toss in a damning or praising letter to the editor while you're at it. You can also enter your QSL in our QSL of the Month contest. All for the low, low price of 25 cents!

Feedback#	Title
1	Welcome Newcomers
2	Never Say Die
3	QRX
4	Home-Brew: Packet Racket Lip Zipper
5	Setting Up a Packet Radio Station
6	Ham Profiles
7	Review: DRSI PC*Packet Adaptor
8	Home-Brew: SX-64 Runs Digicom!
9	Digital Dreams
10	Home-Brew: IC-22S on Packet
11	Home-Brew: One-Chip RS-232 for the C-64
12	Let the TNC Work While Your PC Sleeps
13	Packet Radio in Japan
14	Home-Brew: Standardizing the Radio/TNC Interface
15	Review: GRAPES 56 Kb Modem
16	Packet Radio and High-Tech Nomadics
17	Home-Brew: Improve Your TNC's DCD Circuit
18	TexNet Packet Switching Network
19	Home-Brew: KAM Box
20	Amateur Packet Networking
21	DXDA Awards
22	TCP/IP for the Macintosh
23	Vertical Antennas at HF
24	Home-Brew: HF Packet Tuning Aid
25	New Products
26	Home-Brew: The Quickchanger
27	Index: 10/89
28	Ad Index
29	Special Events
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33	Dealer Directory
34	Barter 'n' Buy
35	Propagation
36	Review: DX Helper
37	Ham Help
38	Tech Tips
39	Review: Flodraw

Continued from page 16

receiver reads about six to seven tenths of the maximum reading previously noted. Your deviation is now set.

Kantronics seems to be a special case when it comes to setting the signal level coming from the TNC. The Kantronics unit uses a jumper rather than a trimpot for setting the signal level. The result is that you have only three choices for signal level. You may well need to change one of the resistors that determines the transmit signal level. In my KPC-2 I replaced the resistor with a trimpot so that I could vary the level according to need.

Getting On The Air!

If you have performed all the steps up to this point your station is ready to put on the air. Now it is time to enter the control commands for the TNC (the add-in boards have their own unique command set so you need to determine on your own which parameters you need to change). Here is a verbatim list of commands to enter: AX25L2V2 ON, MAXFRAME 1, MYCALL WB6RQN (put your own call in on the last command).

The first command enables the later version of AX.25. (AX.25 is a "protocol" agreed on by many packet stations.) The second command allows the TNC to send only one packet before waiting for an acknowledgment. The last command sets your callsign in the TNC (some TNCs will not operate until you enter your callsign).

The next step is to determine the proper setting for the TXDELAY command. TXDELAY determines how long the TNC waits after keying the transmitter before it actually begins sending data. This value is different for every radio and you must take into account the amount of time that it takes for the transmitter to turn on and for the remote receiver to begin decoding your packets. The default value for TXDELAY is usually 300 ms. This means that the TNC begins sending data 300 ms after the TNC keys the transmitter. For voice this is a pretty short time but for packet it is quite long. It is a good idea to try to shorten this time if possible.

Determining the proper value for TXDELAY is not difficult and takes only a few minutes. It requires two stations so it is probably a good idea to get together with other packeteers to perform this operation. Designate one station as the receiver and have its operator turn on monitoring (MONITOR ON). Perform this sequence of tests off the air (use a dummy load) or on an unused frequency since no one else can use the frequency while you are testing. The process:

1. Open the squelch on the receiver so that the TNC is receiving unsquelched noise.
2. At the transmitter set TXDELAY to some low value, say 10 ms (for most TNCs the value for this is 1).
3. Enter a beacon text and enable beacon every three seconds with the following commands: BTEXT TESTING BEACON EVERY 3. At this point the transmitter should key every three seconds and you should hear "packet racket" at the receiver. You may or may not see packets displayed on the screen at the receiver.
4. Enter higher and higher numbers for TXDELAY until the receiver begins displaying the beacon packets. The value of TXDELAY is the amount of time it takes the transmitter to switch from receive to transmit and begin sending valid data. Remember this value as the transmitter switching time.
5. Now close the squelch on the receiver (no noise between packets). The receiver should stop displaying the beacon packets.
6. Continue to increase the value of TXDELAY at the transmitter until the receiver again begins displaying the beacon packets. The difference between the previously determined transmitter switching time and the current TXDELAY is the receiver's squelch opening time. If this turns out to be a very long time, i.e. longer than about 100 ms, I suggest you get a different receiver. For example, my ICOM IC-245 has a squelch opening time of 50 ms.
7. Perform the above sequence of tests for every receiver and transmitter.
8. Set TXDELAY for each transmitter by taking the transmitter keyup delay (calculated in step 4) and adding it to the longest squelch opening time of all the receivers tested.
9. Turn off beaconing at the transmitters (BEACON EVERY 0).

Some receiver/TNC combinations work properly with the squelch left open on the receiver. If the carrier detect light on the front of the TNC does NOT come on with receiver noise (squelch open) but does come on when receiving packets, leave the squelch open at all times. If the carrier detect light is on with noise you have no choice but to close the squelch.

Cutting Down on Collisions

Now is the time to set the parameters that control channel sharing. Check the manual and determine whether or not your TNC has the commands PERSIST and SLOTTIME. The presence of these commands indicates that your TNC supports the more advanced channel sharing technique called P-persistent CSMA (Carrier-Sensed Multiple Access). P-persistent CSMA helps to prevent several stations from trying to transmit at the same time if they all have data to send at the same time.

You may have an older TNC that doesn't support the SLOTTIME and PERSIST commands. In that case you need to use the DWAIT parameter. The original purpose of the DWAIT parameter was to prevent a station from colliding with or "stepping on" a digipeater as it retransmits packets. When the channel is clear, i.e. when no one else is transmitting, and your TNC has data to transmit, your TNC waits for the length of time specified by DWAIT before keying the transmitter. This fixed waiting period is a drawback because two or more stations that have data to send wait patiently for the period specified by DWAIT and then transmit at the same time, guaranteeing a collision. The TNCs that support P-persistent CSMA vary this time based on the SLOTTIME and PERSIST commands so that there is much less likelihood of a collision.

If your TNC does not support P-persistent CSMA, then set the value of DWAIT to be about twice the largest TXDELAY value for all the stations in your local area. This gives those stations with P-persistent CSMA a reasonable chance to get a transmission in ahead of a station that does not have P-persistent CSMA. Don't worry: The P-persistent CSMA stations sometimes wait longer periods so they will often let the other stations transmit first.

If your TNC supports P-persistent CSMA (which it does if it has the PERSIST and SLOTTIME commands) then first enter the following command: DWAIT 0. This disables DWAIT and allows the persistence feature of the TNC to control channel access.

Next, set the value for SLOTTIME equal to the largest TXDELAY value for all of the packet stations in your area (all stations in a given local area should have the same value for SLOTTIME). For instance, if the largest TXDELAY is 26 (260 ms) set SLOTTIME also to 26.

The value of PERSIST is a function of the number of other stations also using the frequency. The formula is: $P = 255 \times (1/n)$, where "P" is the value to be entered to the PERSIST command and "n" is the number of other stations (beside yourself) using the channel. For example, if you are having a QSO and there are four other stations that have QSOs of their own, then there are a total of five stations besides yourself on the frequency. Using the formula above you calculate P to be: $255 \times (1/5)$, or 51. In this case you enter the command: PERSIST 51. If you do not want to spend time calculating the best value for PERSIST a good guess is to set it to 64. This keeps your station from being a bad neighbor most of the time, although it slows things down somewhat when your QSO is the only one on the channel.

Frame Acknowledgment (FRACK)

The last parameter to set is the frame acknowledgment timer (FRACK). This is the amount of time the TNC waits for an acknowledgment after transmitting a packet before it assumes that the packet was lost. Most TNCs set the FRACK value too low and a problem occurs when the channel is busy. The receiver may receive the packet without any problem but, due to channel activity, may not be able to send an acknowledgment within the time allotted by the sender. In these cases the sender must resend the packet.

The solution to this problem is to increase the value of FRACK. Start out with 10 seconds, set with the command: FRACK 10. With a lot of channel activity, set FRACK to 15 or even 20 seconds. (Some TNCs won't accept a value higher than 15 seconds.)

Operating

At this point your station is set up and ready for operation. To connect to another station, for instance WB6RQN, type and enter the command: CONNECT WB6RQN and wait for the "CONNECTED" message. If the other station is too far away to reach directly you may need to use an intermediate digipeater. To connect to WB6RQN via the W3ABC digipeater the command is: CONNECT WB6RQN VIA W3ABC. To add a second digipeater, e.g. W4XYZ, to the string the command is: CONNECT WB6RQN VIA W3ABC, W4XYZ. You are allowed up to eight digipeaters between you and the destination. It's unlikely, though, that you could maintain reliable communication with more than two digipeaters between you and the destination, unless the links are unusually strong and channel activity very light.

Many people discover that their TNC offers a mode that automatically transmits a beacon packet (remember we used that feature to calculate the TXDELAY value). At first thought, this appears to be a good way to tell others that you are on the air and looking for a QSO. On the other hand, imagine what things would be like if everybody transmitted a beacon. So much channel capacity would be used to send beacons that precious little would be left to send data. This is, in fact, what happens, to the ire of everyone. No, beaconing is a bad idea. Avoid it like the plague!

To make a QSO it's much better technique to listen first and then pick a station to try to contact. To ease this process most TNCs offer the MHEARD command. When you enter the MHEARD command, the TNC displays the callsigns of the most recently heard stations. Use this as a guide to the other stations currently on the air.

There is much more to learn about Bulletin Boards and Network Nodes but that is beyond the scope of this article, and is amply discussed in other articles in this Special Packet issue. Following the procedures outlined here lets you extract the maximum performance from your station so that you can spend your time operating, learning about, and enjoying the fascinating hobby of packet radio. 73 and happy packeting! ■

Brian Lloyd WB6RQN has pursued amateur radio enthusiastically since age eight. He recently co-founded Sirius Systems, a networking business in Petersburg, Virginia. You may reach Brian at: 5712 Stillwell Rd., Rockville MD 20851.

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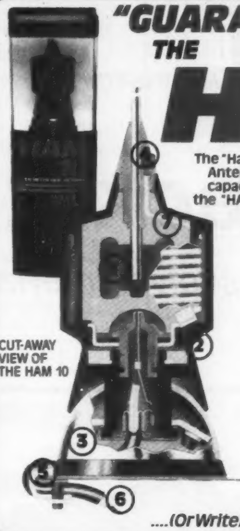

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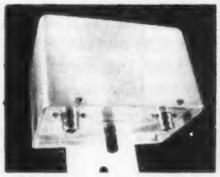

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73 Review

by Brian Lloyd WB6RQN

DRSI PC*Packet Adaptor

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Tel: (800) 999–0204.
Price Class: $140–170,
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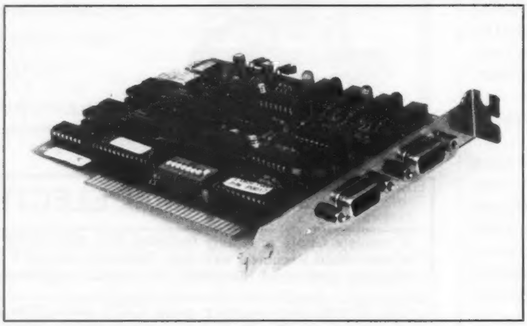
Do you have an IBM-PC/XT/AT computer and operate packet radio? If so, you will want to take a serious look at the DRSI PC*Packet Adaptor (PCPA). This board plugs into your IBM or compatible and turns it into a complete packet radio communications system. With the PCPA, you no longer need a TNC; the PC*Packet Adaptor has all the functions of a TNC, and then some. The software that comes with the board lets you operate it as a TNC, a bulletin board, a Net/ROM node, and a TCP/IP network host. This product is one of the most significant to appear on the packet scene.



*The DRSI PC*Packet adaptor interface board.*

Product Description

The PCPA arrived in the mail. Inside the surprisingly small box was a user's manual, a hardware manual, a get-started-right-now sheet, four 5¼" diskettes, and the PCPA itself. All the material appears to be of high quality, and the board has sockets for all chips so that repairs should be easy if a problem occurs.

The PCPA board uses the standard half-card format for the PC. You can plug it into any slot in any PC/XT/AT compatible computer system. The board is available in three versions, depending on the type of interface desired. The type one board supports one 1200 bps Bell 202 modem (for VHF packet) on-board, and one RS-232 port for interfacing an external modem. The type two board (the version reviewed) has two built-in 1200 bps modems. The type three board has two RS-232 ports and no on-board modem.

If you plan to experiment with modems or to operate on HF, you will probably want the type one or type three board. If, however, you want to operate on multiple VHF frequencies, the type two board is a better choice. If you are unsure, get the type one board. You can always attach a Bell 202 modem to the RS-232 port for dual VHF operation.

The on-board modem I used, the TCM3105 from Texas Instruments, is a single 16-pin DIP occupying little space on the board. Along the top edge of the board are the modem's PTT and carrier detect status LEDs. Each modem also has a watchdog timer to prevent a hardware or software error from keeping your rig key-down forever. Additionally, the modem's transmit and receive signal level controls provide compatibility with just about any radio configuration.

The PCPA has a feature that I have not seen in any other board for the PC; you can run up to four PCPA boards in the same PC, and all the boards can share the same IRQ line. Imagine having eight packet radio channels connected to your PC!

Installing the Board

Type two, the board I reviewed, has two radio ports. I constructed cables to attach it to my 2m and 70cm rigs, without any major problems. Radio hookup was straightforward—as easy as hooking up any TNC. Since the board is inside the PC, there is no TNC-to-computer connecting cable or the hassle that goes along with it.

Before installing the board, you must select the interrupt request line (IRQ) and the I/O address so no conflicts with other devices in the computer will arise. The boards come configured for IRQ-7 and I/O address 300H. Unless you have many strange devices in your computer, the default values will probably work just fine.

If you are using a local area network or have two printers connected to your computer, you may have conflicts between these and the PCPA, requiring you to change the IRQ line, the I/O address, or both. If you need to change the IRQ line, you can select IRQ-2 through IRQ-7. If you need to change the I/O address, you can select 300H or 310H. The documentation is quite clear on how to detect and avoid these problems.

After you have installed the board, do not replace the PC's cover at once. You will need to get at the board to calibrate and set the signal levels.

Software

One of the strengths of the PCPA is that it comes with so much software—the basic PC/TNC package; the "BB" bulletin board package by AA4RE; PC/Node; NET/ROM; BBS package by G8BPQ, and the KA9Q TCP/IP "Net" package. You must decide what your objectives are so you can choose which software packages to install. Since I had enough room on the disk, I chose to install everything the four disks offered.

The PC/TNC package is installed first. It contains the driver for the board, the TNC emulator, and the calibration software. The board and system are ready to use, unless you have a conflict with one of the other boards in your system and have changed the switch settings. Then you will need to run the INSTALL command. This makes the necessary changes to the software packages so they will recognize your board when it has been reconfigured.

After installing the basic software, you can run the calibration program. It is a good test to see if the board is working. If anything strange happens, you can bet that there is a conflict between the PCPA and one of the other boards in your PC. I did run into a conflict, and it showed up during calibration. I removed the conflicting board temporarily, and calibration proceeded without a hitch. Then I changed the switch settings on the PCPA to eliminate the conflict.

Changing the switch settings required running the INSTALL program provided with the PCPA. This process is clearly defined in the documentation so there was no problem.

The next step was to run the background TNC program. This program is a terminate-and-stay resident (TSR) program that runs on the PC in the background and provides all the features of a TNC. There are two flavors of this

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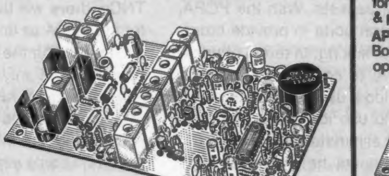

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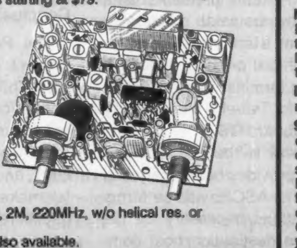

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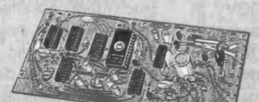

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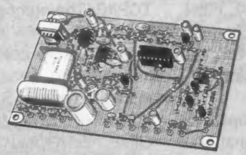

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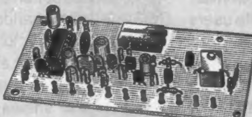

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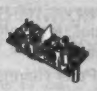

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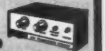

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program: TNCTSR-S and TNCTSR-L. The latter is larger. Although TNCTSR-L has more buffers so you can store more messages and data when operating unattended, I found that TNCTSR-S had more than enough buffer capacity for my use.

To interact with other users, DRSI provides two TNC communication programs: TNCTERM and THS (The Hostmode Server). TNCTERM looks and operates like a dumb terminal connected to a TNC running the WA8DED code. This is what I run in my old TNC-1, so I was immediately at home with this software. The problem with TNCTERM is that it is not very "pretty;" it has no windows or special buffers for brag tapes, for example. It is just a plain old TNC interface.

THS, written by Peter Heinrich HB9CVV, is a much fancier program, and I suspect that most people will want to run it as their terminal program. THS supports several windows for multiple sessions, a window for commands, a number of different buffers for capturing or sending information, and a file transfer mechanism called YAPP (Yet Another Packet Protocol). THS is about the nicest AX.25 packet program I have used. I especially like the multiple receive windows for keeping sessions separate, as I sometimes run two or more QSOs at the same time. The full documentation for THS is on the disk.

Bulletin Board Operation

BB, the second software package, is a very nice multi-connect bulletin board program written by Roy Engehausen AA4RE. This is the best bulletin board program I have used. The documentation is a little sketchy, but I found that I had no problems *if* I very carefully followed the procedures outlined in the documentation (contained in several files on the disk).

BB is a full W0RLI/WA7MBL compatible BBS program with a very nice additional feature: It is multi-connect and multi-user. With BB running, several people can be connected to the BBS at the same time. Where I live, you can wait quite some time in the evening for a chance to log into the BBS to check your mail. BB even supports mail forwarding while users are on the BBS reading or sending mail.

BB takes advantage of the background service provided by TNCTSR. If you are using BB, there is no need to run the big version of TNCTSR. BB runs in the foreground and pretty much takes over the PC, but I suspect that is neither unexpected nor a problem for anyone who already runs a BBS.

I configured BB for one port and had my mail forwarded from the local BBS just so that I could see it in action. I also logged into and used BB from one of my portable packet stations. I had the BBS up and running in about 15 minutes. It performed flawlessly for the couple of days that I had it up. (Some people in the area even logged in and used the BBS.)

As a result, I would not hesitate to recommend BB to anyone planning to set up a BBS. In fact, building a BBS around the PCPA and BB is probably the most cost effective way to get a BBS on the air. Not bad when the best performance also comes at the best price.

PC/Node

NET/ROM by Software 2000 has become a very popular tool for connecting different areas of the world together into a packet radio network. The problem with NET/ROM and its clone TheNet (from Nord> <Link) is that they are ROMs that plug into a TNC. A TNC does not make a very good network node, and you need a separate TNC for each radio you want to connect. If you consider the cost for a two-port NET/ROM node and include power supply, two TNCs, and two NET/ROMs, you will spend the better part of $500. For that price, you can get a PC, the PCPA, and this software. When it comes time to expand to more ports, PC/Node and an additional PCPA are much more cost effective.

Unfortunately, I did not get a chance to try out PC/Node. I did read the documentation that came on the disk, however. Installation and configuration appeared to be quite clear and straightforward.

TCP/IP

The last software package that DRSI provides with the PCPA is a version of Phil Karn's Net program. Net is a complete implementation of the industry standard networking protocol TCP/IP, as well as a full AX.25 and NET/ROM implementation. (There is even a W0RLI/WA7MBL compatible BBS available to work with Net, but it was not available with the DRSI version at the time I tested the PCPA.)

Net is more complex to operate than THS, but it provides much more flexibility. You can make connections via AX.25, NET/ROM, and TCP/IP. The number of connections you can have concurrently are limitless. You can also do multiple file uploads or downloads. Imagine receiving and recording your mail from more than one BBS at the same time.

The NET/ROM capability is nice to have. Other NET/ROMs think that your station is another NET/ROM and can use your station to forward NET/ROM packets. With the PCPA, you can have several ports to provide cross-band and backbone linking. In terms of price, it is less expensive to construct a four-port NET/ROM Meganode using a PC and two PCPAs than it is to use four TNCs and four NET/ROMs. It also eliminates the need for the octopus cable to connect the TNCs together.

Net really shines in running the Internet Protocol Suite (TCP/IP). Many protocols make up this suite, but a few are worth mentioning here. The first is Telnet, a terminal-to-host protocol. Telnet is an official protocol specification for connecting a terminal to a host computer. In amateur radio, Telnet is used to carry on a keyboard-to-keyboard QSO.

The second protocol is the File Transfer Protocol (FTP). FTP provides both binary and ASCII file transfers. The ASCII mode performs all character translations necessary for file compatibility with the destination host computer. Best of all, it is very efficient—a big win over programs like YAPP and BtoA.

The third protocol, the Simple Mail Transfer Protocol (SMTP), is an industry standard electronic mail protocol (the W0RLI BBS supports SMTP messages, if I am not mistaken). Since it is a standard, it is compatible with mail sent by other non-ham computer systems.

Net supports other connection modes besides packet radio. It can use inexpensive local area network cards to interconnect multiple computers. Net also supports RS-232 connections for point-to-point or autodial connections.

I have used Net to connect all the computers in my shack (only one of which is an MS-DOS computer). That way, I could access my computers from anywhere. I take my laptop computer with me and use TCP/IP to send mail, transfer files, or even run programs on the computers back home. Some of the connections use Ethernet and some use RS-232. The only difference is speed, which you can't even detect in most cases.

The RS-232 connection makes another mode of packet operation possible: the "wormhole." Sometimes it is impossible to provide an RF link to connect two stations. In such a case, you can substitute a telephone link to keep information flowing while the RF links are established or repaired.

Since many companies, educational institutions, and governmental agencies use TCP/IP to connect their computer systems, it may be possible to use excess network capacity to give your packets a free ride. In one experiment, several hams using Net built a connection between a shack and a remote host computer using five RF connections and about seven landline and LAN connections. Seven computer networks were involved. It was amazing to see packets moving quickly and reliably between the ham's PC and the remote mainframe hundreds of miles away.

The Future

Lots of new software is becoming available for the PCPA because it is so easy to develop software on the PC. No ROMs, ROM burners, cross compilers, or special development systems are required. This means that, unlike TNCs, there will be more and more software for the PCPA as time goes on. This translates into long life for the PCPA. What capability you have today is only a fraction of what you will have tomorrow. Already the PCPA has been used to perform packet communications at 56 Kbps using the WA4DSY modem. At those speeds, it could even be used for packet voice operation.

Conclusion

The PC*Packet Adaptor is an excellent product; it is reliable and appears to be well-built. The software is nothing short of phenomenal. Would I recommend it? You bet—without any reservations at all. This is what packet radio was meant to be: powerful, fast, efficient, and expandable. The PC*Packet Adaptor makes it worthwhile to get a PC just for packet radio operation.

Brian Lloyd WB6RQN has pursued amateur radio enthusiastically since age eight. He recently co-founded Sirius Systems, a networking business in Petersburg, Virginia. You may reach Brian at: 5712 Stillwell Rd., Rockville MD 20851.

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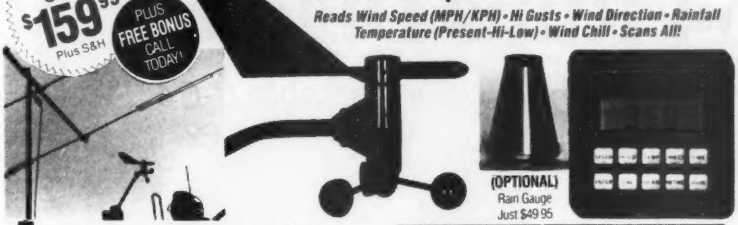

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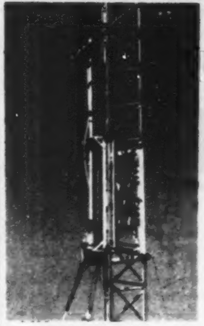

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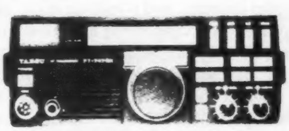

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by Ted Drude KA9ELV

By now, most packet radio enthusiasts are probably aware of the excellent public domain software TNC-2 emulator called Digicom>64, which runs on Commodore C-64 computers. It was originally written by West German hams Stefan Eckart DL2MDL and Florian Radleherr DL8MBT. (See Barry Kutner W2UP's article on Digicom in the August 1988 issue of *73*.)

Digicom is a great way of getting on packet radio, assuming you have a C-64 computer or a compatible system (C-64C, C-128, or C-128D). You can use several types of inexpensive single chip modems with Digicom. Most can be built from scratch or from a kit for under $50. Version 2.0 of the program has many features not even found in hardware TNC-2s, including multi-connects, auto message store and forward, large text buffers, and many BBS-like functions.

While C-64 users have been having a ball with Digicom, Commodore SX-64 owners have been left out in the cold. That is, until now! If you couldn't figure out how to get Digicom running on your SX-64 portable, you can get the complete story here, including how to modify Digicom modems to work with the SX-64, and how to make the proper internal connections.

What Is An SX-64, Anyway?

The SX-64, a portable version of the C-64, operates on AC power. It consists of a C-64 compatible CPU, a 1541 disk drive, a five inch color monitor, and a built-in audio amp and speaker. All components are housed in a 15" x 16" x 5" metal case with a sturdy carrying handle. The detachable keyboard folds up over the screen and disk drive for easy transportation.

The design of the SX-64, with its ample internal power supply and its huge cast-aluminum heat sink, makes it more durable than the C-64. And, unlike most C-64s, you can leave the SX-64 on for days, usually without the worry of overheating or other problems.

Commodore originally sold the SX-64 for $995. When price wars drove the home computer market soft in 1983–1984, these machines were discontinued, and many were sold through surplus and liquidation channels. However, SX-64 repair parts are still available, and many SX-64s in good to excellent condition are currently available at hamfests and computer flea markets for $300–$500.

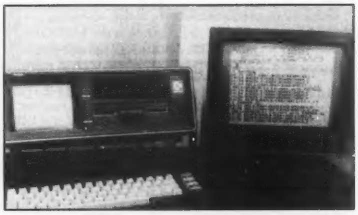

Photo A. This SX-64 (left) is running Digicom>64 Version 2.10 with an internally mounted packet modem. External video monitor (right) displays incoming packets, with Digicom in monitor mode.

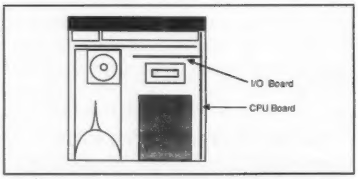

Figure 1. Commodore SX-64 (top view).

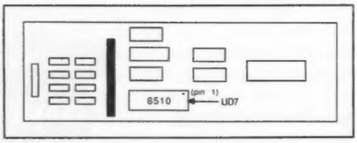

Figure 2. SX-64 CPU Board (component side).

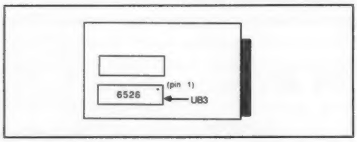

Figure 3. SX-64 I/O Board (component side).

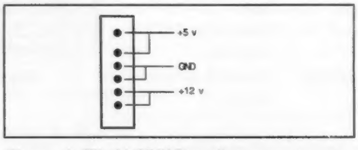

Figure 4. SX-64 CPU Board power connector (detail).

Why Won't Digicom Run on the SX-64?

The SX-64 is virtually 100% software compatible with the C-64, but the hardware is a different story. Digicom is written to address a modem circuit connected to the C-64's cassette port. That's fine for C-64Cs, C-128s, or even C-128Ds, all of which have the nearly obsolete cassette port installed on them. But Commodore, in its infinite wisdom, decided to put all C-64 I/O ports except for the "redundant" cassette port on the SX-64's back panel. Almost all the internal circuitry needed for the cassette port, however, it is still present inside the SX-64; it just isn't brought out to an external port.

Get the Latest Release

Digicom version 1.42 was originally written to overcome the missing cassette port problem since it addressed a modem connected to the user port, which is present on the SX-64. However, this version of Digicom is much less powerful than versions 2.0 and later, as it lacks multi-connects, connect logging, store and forward, and so on. The actual release copies of version 1.42 are buggy and poorly documented.

I suggest you use the latest version (version 2.10 as of this writing). Besides, many SX-64 owners already use the user ports for other things, such as telephone modems, RS-232 ports, or, as I am doing, for home-brew Centronics printer interfaces. The secret is in knowing how to make the right connections between a Digicom modem and the SX-64's internal chips.

Installing the Modem

Begin by removing the ribbed plastic trim panels on both sides of the computer. They're held in place by four small screws, two on each side, in the middle of the back heat sink panel. After removing the screws, slide the panels out toward the rear of the computer.

Next, remove the six countersunk machine screws, three on each side, that are holding the top cover in place. After tnat, remove the two large screws at the top corners of the back

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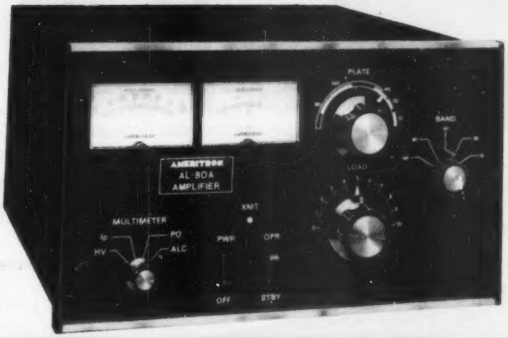

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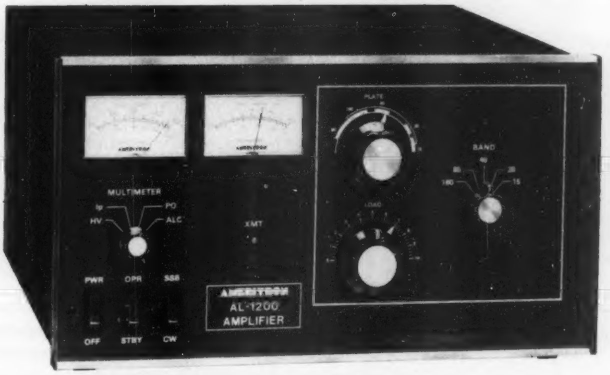

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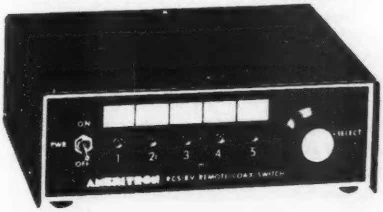

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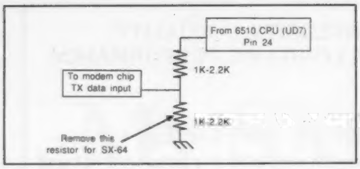
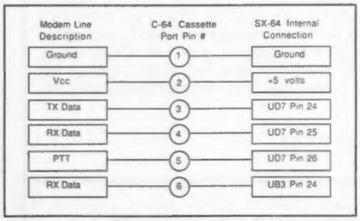


Figure 5. Digicom modem modification for SX-64.



Modem Line Description	C-64 Cassette Port Pin #	SX-64 Internal Connection
Ground	1	Ground
Vcc	2	+5 volts
TX Data	3	UD7 Pin 24
RX Data	4	UD7 Pin 25
PTT	5	UD7 Pin 26
RX Data	6	UB3 Pin 24

Figure 6. Digicom modem to SX-64 wiring diagram.

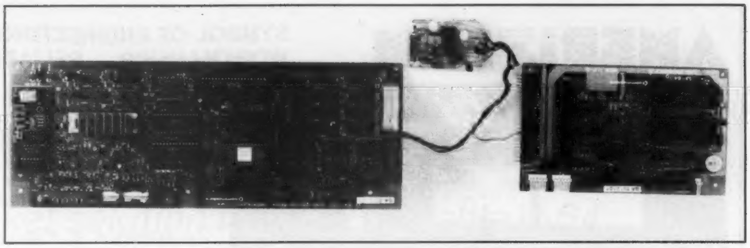


Photo B. You can safely solder the leads from the Digicom modem (top) to the solder side of the SX-64's CPU board (left) and I/O board (right), using a low wattage, grounded iron. Work patiently, use solder sparingly, and avoid bridges.

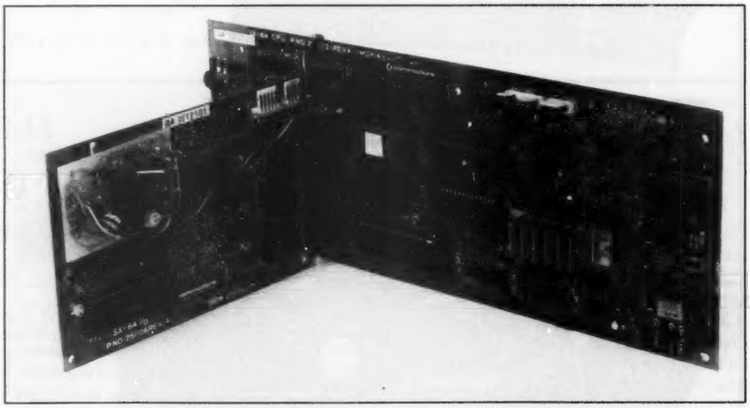


Photo C. Here's the modified N4PLK modem mounted to the SX-64's CPU and I/O boards via a circuit board standoff (upper left corner of I/O board). Connections from modem to transceiver are made by using the external serial port pin socket, cable, and DIN connector.

heat sink panel and (carefully) loosen the two lower screws. This should let you remove the top cover of the SX-64.

Looking down from the top of the open SX-64 (see Figure 1), you can identify the major components of the system. You'll have to remove the CPU and I/O circuit boards, which are located on the right and connected in an inverted L shape. Before you can do this, you have to remove numerous cable connectors that hold the boards in place. Remove the boards as a unit; don't try to separate them inside the case. (A word to the wise: Mark the cable connectors to make sure you reconnect them correctly.)

Identifying the Proper Connections

With the CPU and I/O boards out, you'll want to identify the chips that connect to the Digicom modem. On the CPU board (see Figure 2), find the 6510 microprocessor chip. It's identified as UD7 on the board's silk-screened legend. Connect wires to pins 24, 25, and 26 of this chip.

Now see Figure 3. On the I/O board, find UB3, a 6526 CIA chip. It's the lower of the two 6526s on the I/O board. Connect a wire to pin 24. To find the correct pins on either of these chips, it's faster to start counting from pin 21, the pin diagonally across from pin 1.

If you're mounting the Digicom modem internally, you need to connect to the internal power supply. Fortunately, the SX-64 has enough surplus current to power most modems. The CPU board's power connector is a good place to get regulated voltage. This keyed 6-pin connector is at the lower left side of the CPU board (refer to Figure 2). Both +5 and +12 volts are available, as well as ground (see Figure 4).

Modifying the Digicom Modem

W2UP's article (mentioned earlier) presented a modem circuit capable of both HF and VHF packet operation using the AMD 7910 chip. Craig Rader N4PLK offered a simpler, more compact VHF-only modem using the TCM 3105 chip (see the February 1989 issue of *73*). Other modem circuits, that have appeared in various forms, use the XR-2206/2211 chips. I chose the N4PLK modem for my project because of its small size and single supply source voltage.

While all these modems work with the SX-64, they need a slight modification because the cassette motor supply voltage on the C-64 cassette port, line number 3, isn't at TTL voltage levels. The cassette motor supply voltage, controlled by a bit on the 6510 I/O port, is switched through a transistor network to handle the current. The actual output level varies from 0 to 9 volts, depending on current loads.

Typically, a Digicom modem uses two 1–2.2k resistors in series to act as a voltage divider for line 3 (see Figure 5). This brings the high voltage down to 3–4.5 volts, which is within TTL levels. To modify a Digicom modem for an SX-64, simply remove the resistor going to ground. The voltage divider network then becomes a single series resistor, which you can keep intact if the input line is directly driving a transistor. On the N4PLK modem, line 3 goes to a TTL level input, so I replaced the series resistor with a wire jumper, because the 6510 I/O port lines are rated to drive only a single TTL level load.

Making the Right Connections

When you're ready to connect the modem to the SX-64, follow the wiring diagram in Figure 6. This gives the description of the internal modem line, the equivalent C-64 cassette port line number, and where the line should connect inside the SX-64. I removed the 6-position female edge connector (normally used with the C-64 cassette port) from my modem, and ran jumper wires directly from the modem to the SX-64 circuit boards.

I tried a variety of methods for tapping into the SX-64's circuit boards, including microclips and DIP sockets. The best method appears to be soldering directly to the solder side of the boards, using a low power, grounded solder iron (see Photo B). Work slowly, go sparingly on the solder, keep some desoldering braid handy, and watch out for solder bridges.

Take note of one important connection not shown on the wiring diagram. Pin 24 of UB3 also goes to pin 1 of the serial bus of the SX-64. For some reason, many C-64s must have pin 1 of the Serial Bus disconnected for Digicom to work properly. Some hardware interrupt conflicts appear to cause this problem with certain serial bus devices (especially older disk drives, and printer interfaces). In any case, if you run into this problem, try disconnecting the black jumper wire from P11 to P13 on the I/O board. You can safely remove it without affecting any serial bus operations.

Mounting the Modem and Tidying Up

Before you connect the modem permanently, consider how you plan to mount it. I kept the modem completely internal and mounted it on the I/O board, using a circuit board standoff and insulator available from Radio Shack (see Photo C). With the modem internally mounted and powered, you have to find a way to run the four external lines to your transceiver (AUDIO IN, MIC OUT, PTT, and GROUND). You may decide to run a cable out of the cartridge expansion port, on top of the machine, or use a thin ribbon cable and run it between the side panels.

> ***"While C-64 users have been having a ball with Digicom, Commodore SX-64 owners have been left out in the cold . . . until now!"***

I wanted a cleaner approach, however, without having to drill any holes in either the SX-64's case or its back panel, so I decided to use the external serial bus connector. (I didn't choose the external VIDEO port because I like to run a larger monitor on my SX-64 when I'm not operating portable.) By disconnecting the internal header connector from the I/O board and hooking the first four positions of it to the pin connector on my modem, I have a clean output port for my Digicom modem. The 6-pin DIN serial bus connector on the back panel now mates directly with a shielded cable running to my transceiver.

Kudos

Special thanks to Mike Hooper KF6FU and Dan West K6DFM for their detailed information about Digicom and confirmation that it could run on an SX-64, to Jeff WA6FWI for the details on internal modem connections, to Craig Rader N4SCY for help on modifying the Digicom modem for the SX-64, and to Robert "Ozzie" Osband N4SCY for all the encouragement and moral support, as well as extensive testing of the completed system. ■

Ted Drude KA9ELV has been a ham for 10 years, and especially enjoys packet and 10m FM. Ted is the Associate Editor of Computer Shopper *magazine. Other interests include photography and computer games. You can reach Ted at: 6170 Quito Ave., Cocoa FL 32927.*

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by Bdale Garbee N3EUA

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ATVers: Imagine a national network of amateur High Definition TV (HDTV)—with image resolutions at least twice that of your broadcast TV images—with nearly perfect image transmission between any two places of your choice.

Repeater trustees: Imagine a nationwide repeater linking system, with audio quality as good or better than what your local users are already accustomed to? How about if the snazziest repeater controller you've ever seen was included for free?

Members of public service or emergency communications groups: Imagine how the people you serve would feel about being able to exchange 1000 times as much traffic throughout your state as is presently done, and with less effort.

Computerniks: Imagine having enough space for all the neat applications you'd like to try out. Would you be interested in loading programs from a remote file server located across town, across the state, or even in another country. . . and running them just as if they were on your very own hard disk, and just as quickly?

Special interest folks: Imagine sharing your interest(s) with others around the nation in an ongoing bulletin board forum just like those used on ARPANET, Compuserve, and other networks and online services.

Packeteers: You probably think that you already know what I'm leading up to. But, even as a packeteer, you may not realize the potential of digital communications, using technologies *already available.* All of the above "fantasies" are just a few of the neat things you could do if only you could move enough bits per second through a real packet network. The fact is, you *can*, and this article explains how!

Move Up Frequency

Look upward for the answer. Two meters, where most 1200 baud operation is today, is way too restrictive. There are several very simple reasons for that: 2 meters has become very crowded, and, most important of all, it does not allow us the signal bandwidths needed to run truly high-speed packet. (Recall that the higher the data rate, the wider the minimum bandwidth must be.) The ham microwave bands, however, are still virtually deserted, and there are no signal bandwidth restrictions: You can have a signal many megahertz wide there if you want to! And yet to run packet at the truly awesome rate of 1 Megabaud—*700-800 times* the rate of the standard 1200 baud packet today—requires a signal bandwidth that could easily fit into many of the ham microwave bands.

> ***"Whether your interest is DX, rag-chewing, mobile, repeaters, or CW, a nationwide network supporting a variety of applications can make ham radio even more fun for you."***

For higher speed operation, these bands actually work better than VHF or UHF because small, highly directional antennas can allow our transmitted power to go much more where we want it to, wasting less of it in the wrong direction. Combined with the larger widths of the amateur microwave bands, this advantage allows efficient and affordable high-speed radio links.

One of the lessons to be learned from the recent loss of part of the 220 MHz band is that the FCC may be increasingly concerned with the level of use in various portions of the amateur radio spectrum. If there are bands that we aren't using fully that commercial interests want, we'll have a hard time rationalizing to the FCC why we should be allowed to keep spectrums we're not using. The answer is simple, and without pain. . . find ways to better use these bands!

You may regard the world above a gigahertz with some fear and suspicion. In reality, though, emerging microwave surplus and technology is quickly making it nearly as easy and cheap to build packet hardware for 1.2 GHz or 10 GHz as it is for 144 MHz. Several projects are underway right now that are opening the door to much higher speeds on bands at VHF and above. There is a standardized 9600 baud radio modem now available—a good "next step" for many packet users. Hams in different parts of the country are using 56 kilobaud modems with conventional VHF/UHF transverters, with a good deal of success, on bands as far down as 1.25 meters! Prototypes are being developed for dedicated "digital radios" for the 900 MHz and 1.2 GHz amateur bands that can provide 250 Kbps for a parts cost of under $200 per system. Dayton this year gave us demonstrations of dedicated digital radios for the 10 GHz band, using surplus radar gun modules to achieve between 1 and 10 Mbits/sec, for *under $100* per system! This sort of equipment, which is here **now**, can be put to use in providing high speed user-to-user and interregional digital communications.

Building a Network

We need to be able to efficiently direct packets from one user to another, with minimum hassle. Up to now, the technology amateurs used for building packet networks consisted mostly of TAPR TNC-2s and clones running replacement firmware to provide network functionality. While this was an adequate way to build 1200 baud networks, the Z80 microprocessor used in the TNC forced limitations in speed and software capacity that prevented us from building high speed networks. This is not surprising, since these are Terminal Node Controllers. They were never intended to be network packet switches! To build a fast network we need to look for higher performance solutions.

Luckily, for about the price of a dual-ported configuration (that is, two TNC-2s, and two copies of some networking firmware) we will soon be able to buy a PS-186 packet switch board from AEA that is based on an 80C186 and which has 4 high-speed radio ports. Or, we could use the the K3MC card that will be available soon. This card is based on a NEC V40 (software compatible with the Intel processors) and has two or more medium-to-high-speed ports. Either of these boards is capable of switching multiple high speed channels, and can provide far more memory addressing capacity than Z80-based TNCs.

Challenges Remain

Having faster and more capable packet switching hardware, however, doesn't solve all of our problems. We'll need to work together to solve specific local propagation problems for the hardware to work well, and we will need to agree upon and coordinate data routing at the "software" level so that the packets go quickly and directly to their destinations. These are, however, very manageable problems.

One of the most important difficulties with existing 1200-baud packet networks is the large number of single-port network nodes, either simple digipeaters, or NET/ROM or ROSE nodes (two versions of a network system). When the network must contend with local users for access to the RF channel, the efficiency of a network can easily drop to near zero! The way around this? Install a "backbone" channel—a high data rate channel (e.g. 4800 or 9600 baud) that only the nodes of a packet system use, to automatically route packets between each other. An end user—one who connects into the network—would not have direct access to the backbone. The highly successful TexNet packet network, for example uses 9600 baud backbone channels. We **MUST** further pursue the installation of networking hardware with one or more channels dedicated entirely to "backbone" functionality, the communication between packet switches. Local users can then use separate channels for access, at whatever speeds and using whatever frequencies and modulation techniques are appropriate in each area.

A simple technique for making a dramatic improvement in local packet throughput is to make one or more of the local access channels full duplex—that is, having two channels in full-time operation so that the participating packet stations can transmit and receive simultaneously. This is exactly the same idea as using a repeater for voice. Everyone can hear everyone else, so the chance of two people transmitting at the same time and causing a collision goes way down. And it's no harder to build a full duplex digital repeater than it is to build a voice repeater! Full duplex access channels are already in use in several packet networks around the country.

Software

Having faster modems and radios, however, isn't enough. Once we've begun to build a real network of high-performance packet switches linked with fast microwave links, we will be ready to start experimenting with a wide array of new applications. The importance of having a solid software foundation, using proven networking concepts to provide a consistent and simple interface for writing new applications, will become more apparent.

Fortunately, we're well on our way to

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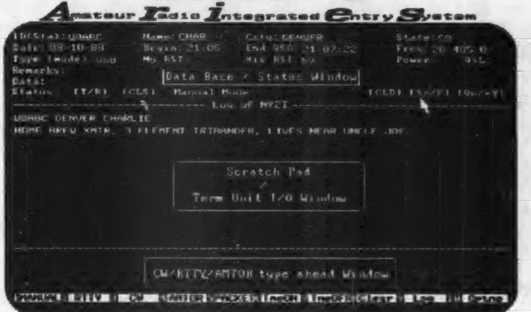

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Status   [T/R]  [CLS]  Manual Mode                 [CLD] [S/F] [9m/+Y]
--------------------------- Log of NY2I ---------------------------
U0ABC DENVER CHARLIE
HOME BREW XMTR, 3 ELEMENT TRIBANDER, LIVES NEAR UNCLE JOE.

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                           /
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CIRCLE 79 ON READER SERVICE CARD

developing the kind of software that can exploit these data rates. There's already a host of networking systems which are being improved by the day (the five most popular systems are featured elsewhere in this issue). Today, among other features, software provides electronic mail, remote log-in and keyboard-to-keyboard QSO functionality, file transfer (including binary files), and the ability to obtain information about users in other areas. There's no limit to the applications that can be added.

Immense Potential

So, what's the bottom line? TNCs and 1200 baud modems and keyboard-to-keyboard QSOs are not the sum and substance of "packet radio." Recognize that what we've done so far in the name of packet radio is but the first small step towards what we are capable of doing. A real digital network won't take away from the present interesting areas of amateur radio . . . it will add to them! Whether your interest is DX, rag-chewing, mobile, repeaters, or CW, a high data rate nationwide packet network supporting a variety of applications can make ham radio even more fun for you.

> *". . . we should recognize that what we've done so far in the name of packet radio is but the first small step toward what we are capable of doing."*

As mentioned above, very inexpensive links on 900 MHz, 1.2 GHz, and 10 GHz, with speeds from 250 kbps to 2 Mbps, have been tested on real paths in Colorado and in Silicon Valley. We will be seeing the first offerings in a new round of packet digital hardware with dramatically higher performance than the TNCs of yesteryear. We will actually have the tools in hand to put a whole new wave of applications on the air. But while we're busy implementing this next wave of packet radio, let us not forget to dream. The young but growing amateur radio digital network needs **YOUR** dreams and help. We've only just begun!

Bdale Garbee N3EUA has long been involved in digital networking, but finally became a ham in 1985 when he came across his first TNC. This began his intense affair with packet radio, which has led him to many achievements, including becoming the system integrater for packet radio's most sophisticated and versatile networking package, TCP/IP, and becoming the Vice-President of the Tucson Amateur Packet Radio (TAPR) group. Bdale currently writes oscilloscope firmware for Hewlett-Packard. Other interests include cooking and reading science fiction. You may contact him at 4390 Darr Circle, Colorado Springs, CO 80908.

Number 12 on your Feedback card

Let the TNC Work While Your PC Sleeps

Give your older TNC personal mailbox capability—with no hardware changes!

by David Bartholomew WB6WKB

Many packeteers are using the older TAPR TNC-2 units, or their clones, manufactured by AEA, MFJ, and others. Unlike some of the newer models from Kantronics and Heath, these TNCs do not provide an automated "personal mailbox" feature to accept incoming messages.

However, there's a procedure that does this very well, and I've used it on the AEA PK-80, the PK-232, and the MFJ-1270 TNCs. It will likely work with other models. This procedure isn't in any TNC manuals I've seen.

Turn Your Packet Answering Machine On

First, turn off all the monitors with MON OFF and MCON OFF. (On the PK-232, use MON 0 and MCON 0.) Set up your CTEXT to say whatever you want. I usually say something like, "Dave's not in, please leave a message here or at WB6YMH-2 . . . 73." Make sure CMSG is ON. Also, if it's not already set on your TNC, set DAYTIME, then CONSTAMP ON and DAYSTAMP ON, too. This will let you know when people contacted you.

Now type in DAY, press Ctrl-S, and type ENTER. This "suspends" the TNC's output. Now disconnect the RS-232 cable from your computer or terminal, and turn it off, but leave the TNC and radio on. This allows you to use your computer for other things while your TNC acts like a packet answering machine for you.

The TNCs I've tried have buffers of 3K or more (depending on the software version). In most cases, this is adequate for several connects. On connecting, a person can leave a short message for you, and when their STA (status) light goes out, they can disconnect.

I disconnect the RS-232 from the computer because sometimes the computer will send a pulse out the interface during power up. This might trigger a Ctrl-Q, and the contents of your TNC would go straight into the bit bucket.

Therefore, follow this procedure to check your TNC when you come back: Power up the computer and go into your terminal program. Set up a "capture file" to disk, or turn your printer on and enable printing. Now reconnect your RS-232 cable, and press Ctrl-Q. Everything should come spilling out of the TNC. (You may also have to press Ctrl-C before it will start.)

The first thing out is the date and time that you suspended your TNC. (We did this operation so that, if nobody connected, all we got was the date and time.) If you do not get this, you'll know that the buffer was lost. This could be due to a glitch on the interface, as mentioned, or a power surge.

If you don't like plugging and unplugging your RS-232 cable, buy a serial switchbox. I have mine connected to switch between my PK-232 and my phone modem. This saves wear and tear on the connectors, and I don't have to reach behind the equipment.

David WB6WKB has been a ham since 1977 and active in packet for several years. A software designer, his other interests include hiking, stargazing, desert geology, and plants. His address is PO Box 7883, Van Nuys CA 91409-7883.

Number 10 on your Feedback card

Put Your IC-22S on Packet

Dust it off and dedicate it to 2m packet!

by Michael S. Dooley KE4PC

Are you tired of tying up your synthesized radio on packet? If you have access to an ICOM IC-22S, a fast and easy fix will get it on this fascinating mode.

With the help of the schematic, find the Reference Oscillator/Divider. This is a 7.68 MHz crystal. Replace that with a 5.12 MHz crystal. This lets you tune the 22S in 10 kHz steps.

The crystal is available through several advertisers I've seen in computer magazines, as well as from any of the crystal manufacturers. I got mine from International Crystal in Oklahoma City. If you order from a manufacturer, include the loading capacitance. Send them a copy of the IC-22S schematic, and the manufacturer will figure out the loading for you. (I didn't know what the loading was, and so asked for a 20 pF one, which works fine.)

Now just follow the Table to configure the diodes for the packet frequencies on which you want to operate. That's it!

Table of Diode Settings for the IC-22S

Frequency	D7	D6	D5	D4	D3	D2	D1	D0
145.00	0	0	1	1	1	1	0	1
145.01	0	0	1	1	1	1	1	0
145.02	0	0	1	1	1	1	1	1
145.03	0	1	0	0	0	0	0	0
145.04	0	1	0	0	0	0	0	1
145.05	0	1	0	0	0	0	1	0
145.06	0	1	0	0	0	0	1	1
145.07	0	1	0	0	0	1	0	0
145.08	0	1	0	0	0	1	0	1
145.09	0	1	0	0	0	1	1	0
145.10	0	1	0	0	0	1	1	1

(0 = diode not installed; 1 = diode installed)

Drawback?

The only problem is that, with the new crystal, the IC-22S works only from just below 145 MHz to 146.94 MHz, and the offset function gives only a definitely non-standard ±400 kHz split. But, what the heck!—this rig was likely busy taking up space on a shelf, while you were tying up a perfectly good synthesized split operation rig on packet. I set my channels as 145.01 MHz on channel one, 145.02 MHz on channel two, 145.03 on channel three, and so on. Works great! ■

The author may be reached at 3801 E. 14th #1401, Plano TX 75074.

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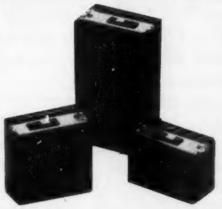

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CIRCLE 191 ON READER SERVICE CARD

Number 19 on your Feedback card

KAM Box

Packet and WEFAX for the lazy.

by Joe Davidson N4AQG

I recently bought a Kantronics KAM for the shack. I had owned a Kantronics UTU and liked their product, so when the "packet-bug" munched on my hamming spirit I went for the KAM. With the KAM I have been able to keep all my favorite modes, plus enter into the new worlds of packet and WEFAX.

Most of my projects around the shack are driven by the desire to reduce excess motion or effort. This project is no exception. If necessity is the mother of invention, then laziness is its father. I have a good share of the latter.

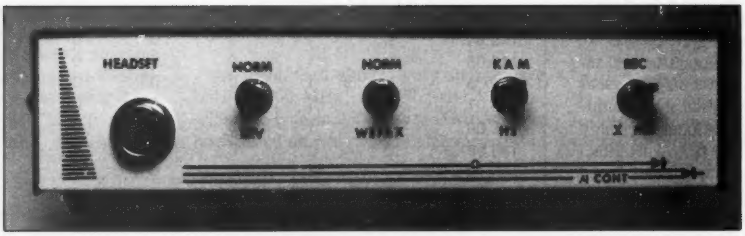

Photo A. Front panel.

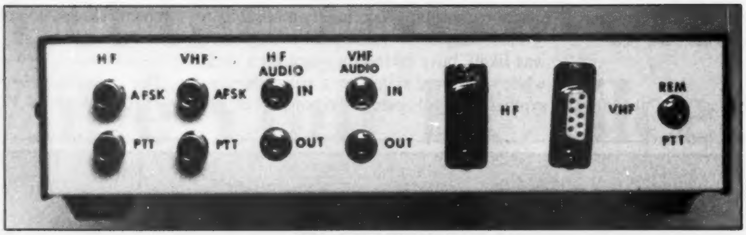

Photo B. Back panel.

Alterations for the Lazy

To copy WEFAX, I had to unplug the HF audio from the HF port and plug it into the VHF port. Then I decided I'd like to work the local VHF RTTY repeater. Kantronics routes the RTTY AFSK through the HF port. Hmmmmm. I could swap the audio ports, but what about the AFSK and PTT? Little idea-gremlins began to scurry around the back of my mind.

I've built several switch boxes in the past so I knew that there was a way around this problem. Out came the paper and pencil, and the drawing began. Figure 1 shows the result.

As I drew, a few ideas bobbed to the surface. I use the phone patch input on my FT-767 GX to input the KAM HF port transmit audio. At a recent hamfest, I bought a used Telex boom mike headset. Why not find a way to use it? Thus, the four-pin mike connector, the remote PTT jack, and the X MIT/REC switch on the front panel.

This box allows me to switch the HF audio alone to the KAM VHF port for WEFAX. It will also reverse the HF and VHF audio, AFSK and PTT to output RTTY on VHF. With a flip of a switch I can use the Telex headset on HF for contesting, DXing, or just plain old gabbing.

Drilling the Connector and Switch Holes

As the parts list reflects, you can buy almost all the parts at your local Radio Shack store.

I chose the cabinet because it would fit into the shack in a minimum of space, and because it had a clean, professional look. Plus, I wanted the shielding properties of a metal case. This particular case has a nice addition—plastic film on the outer surface of both halves. This allows you to center punch and drill holes without scratching the surface. You can then peel the film off and label your box on a clean, unscathed surface.

> **"If necessity is the mother of invention, then laziness is its father."**

I measured and centered the hole locations for the switches and jacks on both panels. Then I cut a wooden block from a scrap two-by-four to fit snugly between the front and back panels. This block will support the panels so they won't bend when punching or drilling. Moving the block under each location before drilling reduces the lip-burr formed by the bit on the inside of the hole.

I center-punched the drill points and drilled first with a 1/8" drill. I used progressively larger bits until the opening was large enough for the collar of the switch or connector to fit through.

To make the DB-9 connector openings, I used a different method. First I drew an outline around one of the connectors at the desired location, then drilled a 1/8" hole in the center of the marked opening. Then I enlarged this hole in two or three stages to ¼". Among the tools on my workbench is a piece of magic called a "nibbler"—small shears that let you accurately make your holes.

I chose the DB-9 connectors for several reasons—they have good shielding properties, and are becoming the connector of choice for serial ports.

Label Pressing and Lacquering

The next step was to dig out the sheets of dry transfer letters I bought from an electronic supply house. I used these to label the switch and connector positions. The package of letters contained several preformed electronic terms, as well as an abundance of letters for composing your own. If you can't find these letter sheets at an electric supply house, office supply and art supply stores carry dry transfer letters in several sizes. You might want to experiment with them a little on a piece of white paper. Make sure there is a hard surface under the paper. Rub over the letters several times with a wooden stick. (A pencil-shaped orangewood stick came with my sheets.) Then peel the backing away,

Continued on page 46

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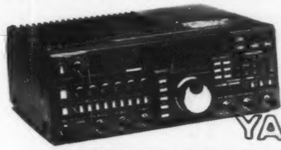

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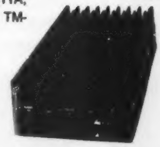

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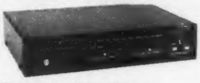

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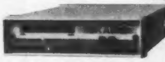

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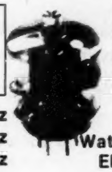

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CIRCLE 41 ON READER SERVICE CARD

One-Chip RS-232 for the C-64

Easy and inexpensive RS-232/TTL level interface.

by Mike Kabala KB0CDQ

I was bitten by the computer bug long before becoming involved with ham radio. Consequently, after I got my license, I was determined to find ways to combine these two interests. Noticing that many hams used Commodore 64s as packet terminals, loggers, Morse code tutors, and several other things, I decided to put mine to good use and connect it to some of my other equipment. I wanted to use the computer's serial port since that would allow me to connect it to modems, printers, packet TNCs, and anything else with an RS-232 serial port.

But What Is RS-232?

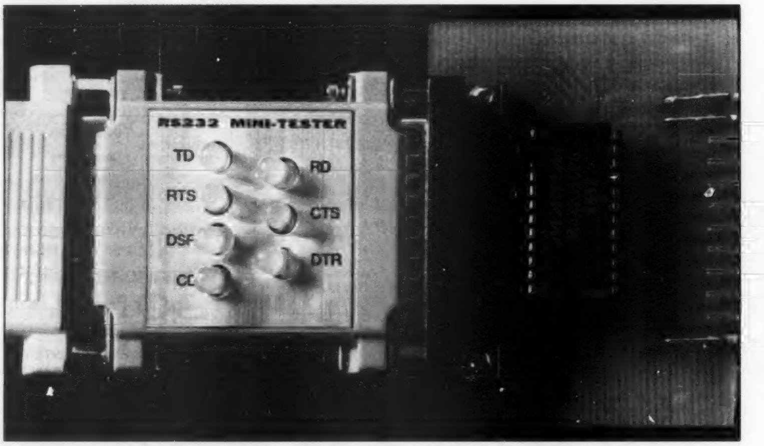
RS-232 is a standard for connecting digital devices together so they can communicate with each other. It was adopted by the Electronics Industries Association (EIA) to make it easier to connect devices made by different manufacturers. The standard defines 25 signals that can be used to establish a protocol between the devices connected. Most equipment uses only a few of these signals. The IBM PC-AT, for example, uses nine, which are attached to a nine-pin connector instead of the traditional 25-pin connector.

When Commodore introduced the C-64 home computer, the company included the same nine signal lines on the computer's serial port. As many owners already know, however, hooking up the C-64 to another device with an RS-232 port is more involved than simply connecting a cable between the two. While the Commodore's signals agree with those defined in the EIA standard, the electrical properties of those signals do not. Commodore's signals are TTL level signals, which means that a signal of 0 V to +0.8 V represents a logic zero, and a signal of +2.4 V to +5 V represents a logic one. The RS-232 standard, on the other hand, represents a zero with a signal of +3 V to +25 V and a one with a signal of −3 V to −25 V.

To make matters worse, the only DC voltages present on the Commodore 64's user port connector (the one containing the TTL level signals) are ground and +5 V. The chip normally used to convert TTL level outputs to RS-232 level outputs is the MC1488, but this chip needs both positive and negative power supply voltages to work properly.

What I set out to do, then, was to find a way to convert all of the Commodore's signals from TTL level to levels that agree with the EIA standard. Furthermore, I wanted to do this using as few components as possible. After asking around a bit, I heard that a company called Maxim Integrated Products made some chips that operate off of a single +5 V supply. In fact, one of them, the MAX232, is used in Heath's Pocket Packet TNC.

While most of these chips require external capacitors, the MAX235 does not. Furthermore, the MAX235 has drivers for five outputs and receivers for five inputs. Since the Commodore 64 has three outputs and five inputs at its serial port, I realized that I could build the entire interface with only one chip!



An RS-232 mini-tester is plugged into the RS-232 port for testing.

Theory of Operation

The MAX235 uses two on-chip charge pump voltage converters to transform the +5 V power supply into +10 V and −10 V. The +10 V and −10 V supplies are then used by the chip's five line drivers to convert the TTL level inputs to +10 V and −10 V RS-232 signals. The receivers use the +5 V supply to convert RS-232 level signals back into TTL level signals. The circuit shown in Figure 1 simply connects inputs to line receivers, outputs to line drivers, and +5 V and ground to the chip's power supply pins.

The MAX235 chip also contains an enable pin and a shutdown pin. The enable line is active low (a TTL zero signal enables the chip), so it has been connected to ground, permanently enabling the outputs of the line drivers. A TTL one level signal on the shutdown pin causes the chip to go into a low-power mode when not in use to save power in battery-powered applications. Since this is of no concern in this project, shutdown has been

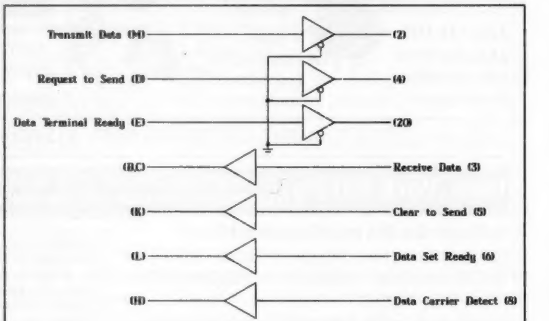


Figure 1. MAX235 IC inputs and outputs.

disabled by connecting it to ground.

Construction

This project is a snap to build, especially if you heed the following tips.

After etching the board, use the four crop marks on the corners as a guide for trimming it. I used a razor saw to trim mine. While the width isn't that critical, the front and rear edges of the board could interfere with the connectors if not properly trimmed. Take care, though, when trimming the edge closest to the DB25 connector; the traces come very close to this edge.

If your male DB25 connector has mounting holes, by all means use them. If, like me, you are constantly joining things and then taking them apart, this connector and the card-edge connector suffers a lot of wear and tear. Even if the installation is permanent, normal use can still strain the connectors. Over time, mechanical stress applied directly to the solder connections will cause them to separate.

The part of the board on which the card-edge connector is attached has been designed for maximum flexibility in choosing a connector. It must, of course, contain two rows of 12 contacts of 0.156-inch centers, but the solder side of the connector can be either the right-angle type or one with straight contacts. The right-angle type is better, since you can bolt them directly to the board, adding to its durability. For this, I provided two sets of hole patterns, one for 0.150-inch spacing between rows and the other for 0.200-inch spacing. Use the set that matches your connector and ignore the extra row of holes. If possible, drill mounting holes for bolting the connector to the board.

If your connector has straight solder tails, place the board between rows of contacts and solder the side touching the copper into place. You will have to drill holes and attach jumpers to reach the other row of contacts. Only three of these are needed—1, 2, and 12—since the other pads have no leads attached to them.

I recommend using a socket for the MAX235 chip. With it, it's easier to check for solder bridges before inserting the chip. Be sure that the chip is oriented correctly, so as not to damage it when applying power.

The two jumpers are optional. They connect pin one (protective ground) of the DB25 connector to pin seven (signal ground). Occasionally, these need to be tied together. (Again, I have never known this to be the case, but it might occur in the future.) Solder a wire between the two terminals of JP2. The terminals of JP1 are on .10-inch centers so that a removable jumper plug can be inserted. Solder two jumper pins to these holes.

Testing and Using the Device

Once you have soldered all components into place, attach a jumper plug at JP1. If you are using a socket, leave the chip out for now. Check for a solder bridge across the power supply by connecting an ohmmeter between pins one and two of the card-edge connector. In a similar manner, check for bridges between the pins of the card-edge connector, between the pins of the DB25 connector, and between pins of the chip socket. There should be a short between pins one and A, pins 12 and N, and pins L and M of the card-edge connector. There should also be a short between pins 21 and 22 of the chip socket. No other shorts should exist between any two pins of the same connector.

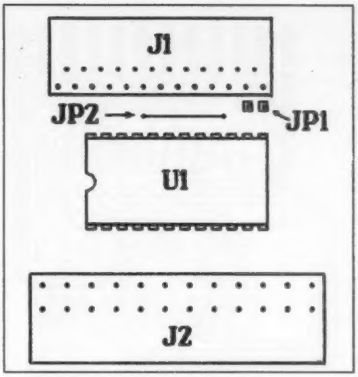
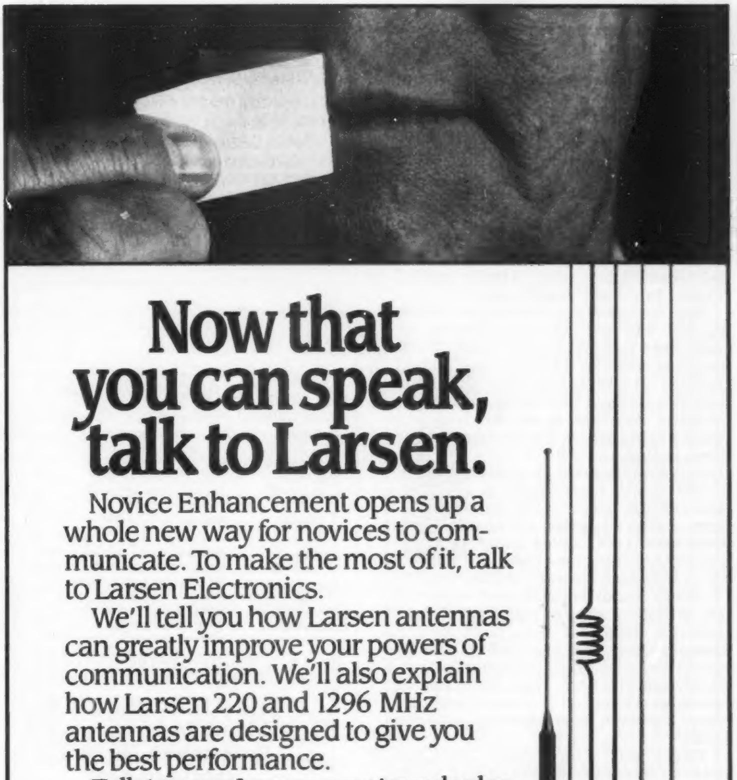


Figure 2. Interface component layout.

When you have removed all solder bridges, insert the MAX235 into the socket, taking care to observe the proper orientation. Make sure that all pins are in the socket and that no pins are bent under the chip. Next, insert the card-edge connector into the user port of your Commodore 64 with the chip facing up. Plug an RS-232 mini-tester (available at Radio Shack) into the DB25 connector if you have one.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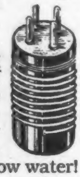

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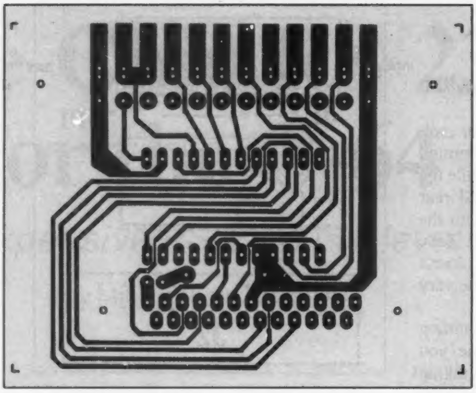

Figure 3. PC board foil diagram for the interface. Not a lot of part stuffing here!

Parts List

Part	Description	Cost
U1	MAX235 RS-232 driver/receiver	$25.00
(U1)	Socket for U1	$ 1.00
J1	Male DB25 with right-angle header	$ 4.00
J2	Card-edge connector 12-position dual-readout on 156 mil centers	$ 3.50
–	Printed circuit board (etched)	$10.00
JP1	Removable jumper	$ .50
JP2	Wire jumper	$ .01
–	Solder and mounting hardware	$ 1.00
MAXIMUM total cost (assuming NO junk-box parts):		$45.01

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Apply power to the Commodore 64 and observe the mini-tester. The TD, RTS, and DTR indicators should be lit. All others should be off. If you do not have a mini-tester, place the ground lead of a DC voltmeter on pin seven of the DB25 and check for a voltage of about +10 V at pins two, four, and 20.

Now, turn off the Commodore 64, attach the mini-tester to the device you wish to connect to the computer, and apply power to the device. If the RD indicator lights and TD, RTS, and DTR remain off, you can probably connect the Commodore to the device with a straight RS-232 cable. If RD remains off and TD comes on, you will need a null-modem. RD is on pin three of the DB25 connector.

There are many types of null-modems in common use, so consult the manual for the device to be connected to determine which type you need. If there is more than one diagram, use the one shown for an IBM PC.

Now turn off both the computer and the device and connect them via their serial ports. Turn on the device and the computer, as indicated in the device manual, and attempt to send and receive data between the two machines. (If you are attaching a printer, try sending data only.) You should be able to get your new port working without too much trouble by following the instructions in the manual.

Summary

I have built three of these interfaces so far. The first one was installed *inside* a Commodore 64 and brought out to an IBM PC-AT style DB9 connector attached to the side of the computer. I have used it, at various times, to attach the computer to a packet TNC, to an IBM PC, and even to an Apple Laserwriter printer running at 9600 baud. (Yes, the plural of baud is baud!) The second one is being used by a friend to connect his Commodore 128 computer to his laser printer. I keep the third one on hand for use with my Commodore 64C. I have had no problems with any of these interfaces, and they are very easy to build, so warm up that soldering iron!

About Parts

There's just one hitch: I have checked several sources and have not yet found anyone interested in providing the MAX235 chip in single unit quantities. It is possible to get ten or more, however. Assuming at least ten people will want to build this project, I will make the chips available for $25 each. I will also supply pre-etched circuit boards for $10 each and complete kits for $50. Send a check or money order in U.S. funds to *Mike Kabala KB0CDQ, 144 W. Spring Street, Eldridge, IA 52748.*

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Packet Radio in Japan

Bits of information on packet in the land of the Rising Sun.

by David Cowhig WA1LBP

In the June 1989 issue of *CQ Ham Radio* (Japan), Mr. Inoue JR1VMX points out that about 50 Japanese hams, mostly in the Tokyo area, now use the 9600 baud FAX modem chips made by Rockwell (the R96MD or R96FAX) or by Yamaha (the YM7910) to operate 9600 baud packet. These chips have become widely available with the proliferation of G3 9600 baud FAX machines. JA8IJY and JA6FTL successfully demonstrated G3 ham radio facsimile at 9600 baud on 21 MHz SSB and 29 MHz FM. JI1FGX and JA1VAS have developed an Ethernet controller and microwave equipment for full duplex communications at 10 megabits per second at 10 GHz, based on conventional wired LAN (local area network) technology. Important software upgrades have been made to several types of TCP/IP radio computer network systems for rapid and efficient distribution of news along networks such as the JK1RJQ, JK1LOT Terakoya, and NOS TCP/IP systems.

A Little Geography

Japan, a country about the size of California, has 1.6 million hams (ham operator licenses last a lifetime in Japan) and about 700,000 station licenses (station licenses are renewed every five years) concentrated mostly along the seacoast on either side of the mountain ranges in the interior of the country. As in California, the population density along the coast (about 40 million people live within 100 miles of Tokyo) and the advantages of high repeater sites in the mountains contribute to the popularity of the VHF and UHF bands. Few digipeaters and FM repeaters use the very crowded 144–146 MHz band, but there are hundreds of repeaters and digipeaters on both the 430 MHz and 1200 MHz bands.

Can't Take Just One Byte

For the English language, we need represent only 26 letters of the alphabet in upper- and lower-case, the numbers zero through nine, and assorted symbols—all of which fits comfortably in 256 combinations. This lets us use only eight-bit bytes to represent a character.

Not so for the Japanese, who commonly use 2000 kanji characters and two sets of a 51 character phonetic syllabary. Japanese word processors and packet controllers (TNCs) use two bytes to represent each of 6000 characters according to the JIS (Japan Industrial Standard) code. Shift-JIS uses two eight-bit digital blocks to create a 16-bit expression for a single kanji character.

FAX in Japan

Talking and sending written messages is fun, but how do you send a circuit diagram, a map, or a drawing to your fellow hams? Well, facsimile and packet image communications have become popular in Japan. Many Japanese hams exchange drawings and maps by adapting the very popular G2 (minifax) telephone FAX machines for radio use. As the speed of these FAX machines increases, many Japanese hams buy inexpensive used FAX equipment. Some hams operate 4800 baud facsimile machines which can send and receive a FAX graphic in less than one minute. Keizo Fukunishi JA8IJY demonstrated a simple interface circuit for 9600 baud telephone FAX machines to put them on HF SSB and FM at 9600 baud, and a tuning circuit for receiving 9600 baud FAX signals. Transmission speed of these G3 FAX machines can be stepped down as low as 2400 baud if necessary.

> ***"Shift JIS-uses two eight-bit digital signals to create a 16-bit expression for a single kanji character."***

Japanese hams are exchanging vivid, high resolution color graphics by packet radio using the North American Presentation Level Protocol Syntax (NAPLPS). Akihisa Kurashima JM1VSP wrote an implementation of the Telidon NAPLPS videotex system which runs on IBM PCs with CGA or black and white monitors as well as on the NEC PC-9801 and several other Japanese computers. NAPLPS uses the geometric method to create drawings using graphics commands.

NAPLPS graphics data files are much smaller than those of drawings made using the photographic bit-by-bit method. NAPLPS can switch new character sets in and out of the 256 character set which can be specified using one byte. Thus, NAPLPS can use more than 256 characters in drawing pictures using supplementary character sets which may be NAPLPS-standard, or user-defined. A packeteer can use the operation codes (op codes) of the Picture-Description set to perform operations such as drawing lines, arcs, rectangles, selecting which color to use, etc. The op codes and the character sets make it possible to send a high resolution graphics image using far less information than would be required to send the same image by a video system (slow-scan or fast-scan TV).

Japan's Packet Wish List

Today's packet dreams shape tomorrow's packet future. What are some Japanese packet dreams? Mr. Inoue JR1VMX:

"Packet radio is the second great revolution in amateur radio (the first opened up the shortwave bands). Packet radio brings hams together in a unique way. We need each other to maintain and operate the packet networks if packet is to work. Thus, we have a strong interest in improving the technical understanding of our fellow hams. The arrival of 9600 bps one-chip modems, and especially the successful experiments of Mr. Ueno JI1FGX with 10 megabit per second data transmissions at 10 GHz, open up new possibilities. Some of these are fast-scan TV transmission via packet radio and improved performance for today's TCP/IP news distribution networks and their interfaces with packet BBS. Packet databases and voice data transmission are becoming more practical. Rapid advances in software, hardware and network organization are making this a very exciting time for ham radio. We are reaching towards our goal of free and reliable communications among all the hams of planet Earth."

Dave Cowhig WA1LBP is 73 Magazine's Japanese translator. Contact him at 6317 May Boulevard, Alexandria, VA 22310.

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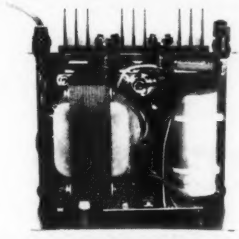
INSIDE VIEW — RS-12A

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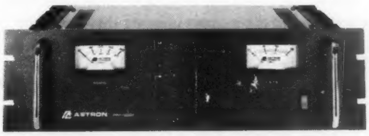
- RIPPLE Less than 5mv peak to peak (full load & low line)
- **Also available with 220 VAC input voltage**

MODEL RS-50A

MODEL RS-50M

MODEL VS-50M

RM SERIES


MODEL RM-35M

19″ × 5¼ RACK MOUNT POWER SUPPLIES

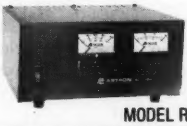
MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
RM-12A	9	12	5¼ × 19 × 8¼	16
RM-35A	25	35	5¼ × 19 × 12½	38
RM-50A	37	50	5¼ × 19 × 12½	50
• Separate Volt and Amp Meters				
RM-12M	9	12	5¼ × 19 × 8¼	16
RM-35M	25	35	5¼ × 19 × 12½	38
RM-50M	37	50	5¼ × 19 × 12½	50

RS-A SERIES

MODEL RS-7A

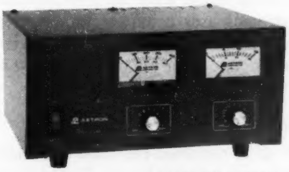
MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
RS-3A	2.5	3	3 × 4¾ × 5¾	4
RS-4A	3	4	3¾ × 6½ × 9	5
RS-5A	4	5	3½ × 6⅛ × 7¼	7
RS-7A	5	7	3¾ × 6½ × 9	9
RS-7B	5	7	4 × 7½ × 10¾	10
RS-10A	7.5	10	4 × 7½ × 10¾	11
RS-12A	9	12	4½ × 8 × 9	13
RS-12B	9	12	4 × 7½ × 10¾	13
RS-20A	16	20	5 × 9 × 10½	18
RS-35A	25	35	5 × 11 × 11	27
RS-50A	37	50	6 × 13¾ × 11	46

RS-M SERIES


MODEL RS-35M

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
• Switchable volt and Amp meter				
RS-12M	9	12	4½ × 8 × 9	13
• Separate volt and Amp meters				
RS-20M	16	20	5 × 9 × 10½	18
RS-35M	25	35	5 × 11 × 11	27
RS-50M	37	50	6 × 13¾ × 11	46

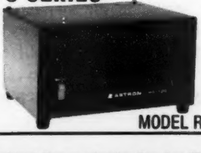
VS-M AND VRM-M SERIES


MODEL VS-35M

- Separate Volt and Amp Meters • Output Voltage adjustable from 2-15 volts • Current limit adjustable from 1.5 amps to Full Load

MODEL	Continuous Duty (Amps)			ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
	@13.8VDC	@10VDC	@5VDC	@13.8V		
VS-12M	9	5	2	12	4½ × 8 × 9	13
VS-20M	16	9	4	20	5 × 9 × 10½	20
VS-35M	25	15	7	35	5 × 11 × 11	29
VS-50M	37	22	10	50	6 × 13¾ × 11	46
• Variable rack mount power supplies						
VRM-35M	25	15	7	35	5¼ × 19 × 12½	38
VRM-50M	37	22	10	50	5¼ × 19 × 12½	50

RS-S SERIES


MODEL RS-12S

- Built in speaker

MODEL	Continuous Duty (Amps)	ICS* Amps	Size (IN) H × W × D	Shipping Wt. (lbs.)
RS-7S	5	7	4 × 7½ × 10¾	10
RS-10S	7.5	10	4 × 7½ × 10¾	12
RS-12S	9	12	4½ × 8 × 9	13
RS-20S	16	20	5 × 9 × 10½	18

*ICS—Intermittent Communication Service (50% Duty Cycle 5min. on 5 min. off)

Standardizing the Radio/TNC Interface

Patch any rig to any TNC or data controller in just a few moments!

by Brian Lloyd WB6RQN

If you're like me, you want your packet station to perform well. To that end, you've carefully constructed a cable that connects your TNC to your radio. The cable has the appropriate TNC connector on one end and the appropriate radio connector on the other. You've also carefully adjusted your TNC to produce the proper signal level to modulate your rig to precisely 3 kHz deviation. The result is that everybody can copy your packets.

Now you participate in a simulated emergency test, arriving, setting up, and operating. Uh oh, the rig dies, and you have to make do with a different one. Thirty minutes, several clip leads, and much level-pot diddling later, you're back on the air—except no one is sending you any more traffic. It's all going to the voice operators, since their stuff was working and yours wasn't.

Or maybe, like me, you have five TNCs and five radios. Life can get a little complicated unless you dedicate each TNC to a particular radio. What if you want to experiment, or just recover from a radio or TNC failure? You're out of luck.

The Solution

Well, I got tired of both these situations and came up with a solution: a standardized cabling scheme that completely hides the differences between my TNCs and radios. It makes the radios think all the TNCs have the same connector, pinout, and signal levels and, likewise, makes the TNCs think all the radios have the same connector, pinout, and signal levels.

If this situation actually existed, only one type of interconnect cable would be required between the TNCs and radios. In the real world, the situation can be mimicked by having two cables for each installation, one for each radio and one for each TNC. The cables then connect in the center using a standard connector.

The Standard Interface

To do this, I first had to define my "standard" interface. I chose a DB-9 connector, since they're readily available (Radio Shack carries them) and they're available with shielded hoods, so it's easy to construct a fully shielded cable assembly. Figure 1 shows the standard interface connector I designed and the signals passing through it.

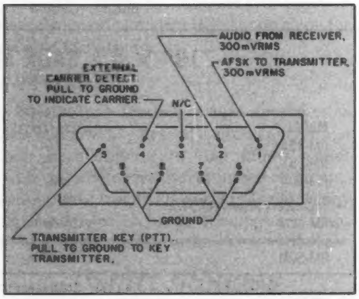

AUDIO FROM RECEIVER, 300mVRMS
AFSK TO TRANSMITTER, 300mVRMS
EXTERNAL CARRIER DETECT PULL TO GROUND TO INDICATE CARRIER
N/C
5
4
3
2
1
9
8
7
6
GROUND
TRANSMITTER KEY (PTT), PULL TO GROUND TO KEY TRANSMITTER.

Figure 1. The author chose the DB-9 connecter as the "standard" interface connector, because of its ubiquity and good shielding properties.

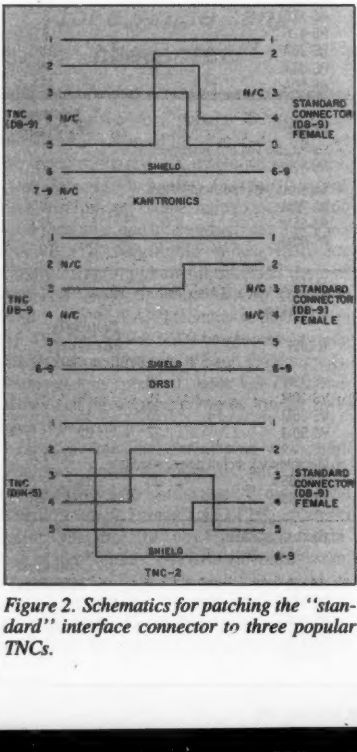


Figure 2. Schematics for patching the "standard" interface connector to three popular TNCs.

The TNC Cable

With the interface already designed, your next step is to construct the TNC cable, since it's the most straightforward. This cable will have the appropriate TNC connector on one end—DIN-5 for TNC-2; DB-9 for TNC-1, DRSI, or Kantronics; and so forth—and a DB-9 "standard" connector on the other. Figure 2 shows the schematics for several popular TNCs.

Because TNCs are both sensitive to RF and wonderful producers of EMI, be sure to use a well shielded cable and use ferrite beads to head off the flow of RF. I put a single large bead over the whole cable to reduce or eliminate RF from the outside of the shield.

Once the TNC cable is finished, you must adjust the TNC to produce the "standard" transmit signal level. I chose 300 mVRMS because it should be more than sufficient to drive any radio. Most TNCs include a trimpot to set the transmit audio level. Simply adjust the pot to produce a 300 mVRMS signal into a 500Ω load.

If you have a Kantronics TNC, you'll have to modify it slightly, using a "standard" mod described in the Kantronics documentation. Kantronics uses a jumper to select one of three transmit signal levels. Choose a resistor value for one of the jumper positions that will set the output level to 300 mVRMS.

The Radio Cable

Now to construct the cable that hides the differences between radios. This cable is a bit more complicated, since it must map the standard pinout to the pinout of the transceiver's connector, attenuate the standard 300 mV signal level to the level expected by the radio, and deal properly with the different PTT schemes.

The biggest problem is attenuating the

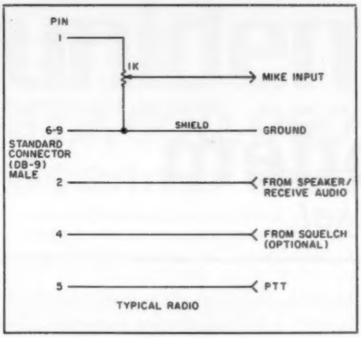

PIN
1
1K
MIKE INPUT
6-9
SHIELD
GROUND
STANDARD CONNECTOR (DB-9) MALE
2
FROM SPEAKER/ RECEIVE AUDIO
4
FROM SQUELCH (OPTIONAL)
5
PTT
TYPICAL RADIO

Figure 3. Radio interface cable diagram for many types of transceivers.

signal to the proper level so that, in the case of a VHF or UHF NBFM radio, the high tone generates 2.5 to 3.0 kHz of deviation. I usually start out using a trimpot to determine the proper amount of attenuation, and then replace the trimpot with two resistors. As long as you don't change the deviation control in the radio, the cable will always ensure proper modulation.

> **"Because TNCs are both sensitive to RF and wonderful producers of EMI, be sure to use a well shielded cable and use ferrite beads to head off the flow of RF."**

Most radios use the same technique for keying the rig: They pull the PTT line to ground. This means that all you need to do is route the PTT line from the TNC to the radio's PTT line.

Some radios, notably handhelds, have a different PTT control scheme. ICOM uses continuity to ground from the center pin on the mike jack to key the transmitter. A Kenwood is keyed when the mike ring connector is connected to ground (the audio-out or external-speaker ground).

Figure 3 shows interface cable schematics for a typical radio, Figure 4 shows the same for an ICOM HT, and Figure 5 shows the same for a Kenwood TR-2500 HT. Notice that each cable includes a trimpot to set the signal level. Adjust the pot for 3 kHz deviation of the transmitter when the standard level of 300 mV is applied to the cable. After adjustment you can measure the trimpot and replace it with two fixed resistors to make your cable more compact.

When you get your setup working, swap TNCs and radios with friends to make sure everything is truly universal. From then on you can rest assured that making changes in your packet station will be a "plug and play" operation! ■

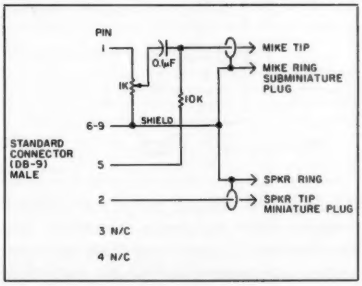

PIN
1
0.1µF
MIKE TIP
MIKE RING SUBMINIATURE PLUG
1K
10K
SHIELD
6-9
STANDARD CONNECTOR (DB-9) MALE
5
SPKR RING
2
SPKR TIP MINIATURE PLUG
3 N/C
4 N/C

Figure 4. . . . and for an ICOM HT . . .

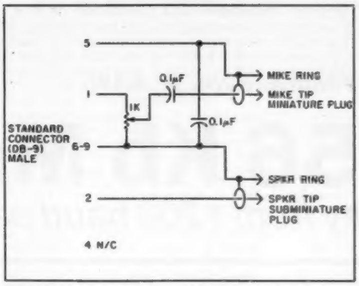

5
0.1µF
MIKE RING
MIKE TIP MINIATURE PLUG
1
1K
0.1µF
STANDARD CONNECTOR (DB-9) MALE
6-9
SPKR RING
2
SPKR TIP SUBMINIATURE PLUG
4 N/C

Figure 5. . . . and for the Kenwood TR-2500 HT.

Brian Lloyd WB6RQN has pursued amateur radio enthusiastically since age eight. He recently co-founded Sirius Systems, a networking business in Petersburg, Virginia. You may reach Brian at: 5712 Stillwell Rd., Rockville MD 20851.

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BOOM: 6'	N.F.: 1.2dB	N.F.: 6.8dB MAXIMUM
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73 Review *by Philip R. Karn, Jr. KA9Q*

GRAPES, Inc.
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Alpharetta GA 30239-0871
Price Class: $250, in kit form

GRAPES 56 Kb Modem

We've come a long way from 1200 baud packet.

How would you like to be able to send the equivalent of a standard 5.25" IBM PC floppy disk (360 Kbytes) by packet radio in less than two minutes? How about transmitting telephone-quality digital voice over the air? Sound too good or expensive to be true? Not at all! It's being done right now, with equipment and software available to any interested amateur.

The key is the 56 Kb/s modem designed by Dale Heatherington WA4DSY and distributed by the Georgia Radio Amateur Packet Enthusiasts Society (GRAPES). Since its unveiling at Dayton in 1987, this modem has progressed through the experimental and beta test stages and is now in routine production and use.

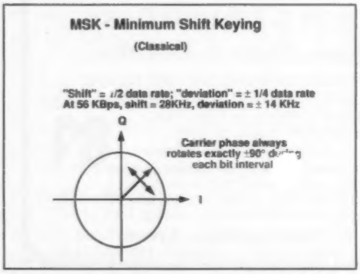
MSK - Minimum Shift Keying
(Classical)
"Shift" = 1/2 data rate; "deviation" = ± 1/4 data rate
At 56 KBps, shift = 28KHz, deviation = ± 14 KHz
Q
I
Carrier phase always rotates exactly ±90° during each bit interval

Figure 1. MSK, a form of Frequency Shift Keying (FSK), uses the smallest possible mark/space frequency shift for the data rate in use. This keeps the signal bandwidth to a minimum.

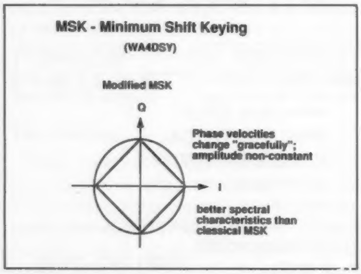
MSK - Minimum Shift Keying
(WA4DSY)
Modified MSK
Q
I
Phase velocities change "gracefully"; amplitude non-constant
better spectral characteristics than classical MSK

Figure 2. The 56 Kb modem uses a modified form of MSK.

Keying Scheme

The WA4DSY modem uses a modified form of Minimum Shift Keying (MSK) (see Figures 1 and 2). MSK is just a special form of Frequency Shift Keying (FSK), well known to every HF RTTYer. As the name implies, though, MSK uses the smallest possible mark/space frequency shift for the data rate in use, keeping the signal bandwidth to a minimum.

In RTTY terms, the carrier "shift" in Hz is equal to one-half of the data rate in bits per second; at 56,000 bits/sec, the mark/space shift is 28 kHz. In FM terms, the "deviation" of the signal is plus and minus one-quarter of the data rate, or ±14 kHz at 56Kb/s. If you select a different speed in the modem, the shift changes automatically; the transmitted signal is generated digitally in a state machine, so you can't get it wrong!

The WA4DSY Modem Kit

The kit includes three PC boards: transmit encoder, receive decoder, and RF board, plus all necessary board parts except the channel crystals. Unlike virtually all other amateur packet radio modems, the WA4DSY modem is not an add-on to a standard voice transceiver. Instead, it operates with a VHF or UHF transverter (transmit/receive converter) such as those made by Microwave Modules or SSB Electronics. You must buy the transverter separately.

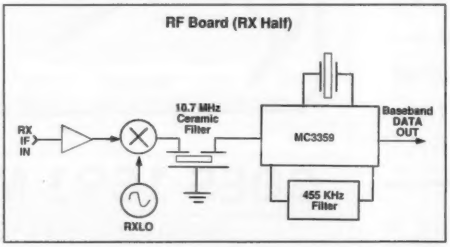

Figure 3. The receive portion of the WA4DSY modem design.

Transverters have the needed bandwidth to pass the high speed modem signal (75 kHz). Also, they are typically cheaper than full-voice transceivers because they lack an audio section, synthesizer, and the other extras that aren't necessary for dedicated packet operation. The RF section of the WA4DSY modem operates near 28 MHz, so you can use it on any band where you can use a transverter designed for a 10 meter transceiver. (Because of FCC bandwidth limits, however, you may only use this modem at full speed on frequencies above 220 MHz in the US. See section 97.69 of the regs.)

The RF modulator produces approximately 1 mW (0 dBm), enough to drive the Microwave Modules transverter, configured for low drive level, to full power. The RF demodulator is sensitive enough to work well when fed directly from a typical receive converter. The transverter must be modified to decrease its transmit/receive switching time, but this is a simple operation involving the removal of a single capacitor.

The WA4DSY modem design is highly modular. You can saw the RF board's receive and transmit into halves and build completely independent receivers and transmitters if you wish (e.g., for dedicated, full duplex links). See Figures 3 and 4.

The digital side of the modem provides six interface signals, three each for the transmitter and the receiver. All signals are TTL levels; if the host computer uses RS-232 signals you must either modify it to produce TTL or insert RS-232/TTL level converters.

As standard with commercial high speed synchronous modems, the WA4DSY modem provides both transmit and receive bit clocks. This eliminates the need for a baud rate generator in the host computer interface. It also means you can use older and less expensive HDLC chips like the Zilog SIO without having to provide a "state machine" circuit like that in the TAPR TNC-2 for recovering clock from the receive data stream.

In addition to the data and clock input/output signals, the WA4DSY demodulator also accepts a Request-to-Send (RTS) signal for keying the transmitter, and it provides a Data Carrier Detect (DCD) signal.

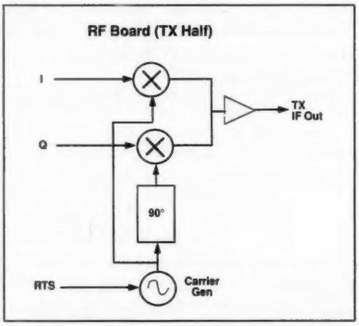

Figure 4. The transmit half of the WA4DSY modem. Since the design is modular, you can saw the RF board in half to set up a completely independent receiver and transmitter section.

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12-Band, 100 Channel • Crystalless • AC/DC

Frequency range: 29-54, 118-174, 406-512, 806-956 MHz.

Excludes 823.9875-849.0125 and 868.9875-894.0125 MHz.

The *Bearcat* 760XLT has 100 programmable channels organized as five channel banks for easy use, and 12 bands of coverage including the 800 MHz. band. The *Bearcat* 760XLT mounts neatly under the dash and connects directly to fuse block or battery. The unit also has an AC adaptor, flip down stand and telescopic antenna for desk top use. 6-5/16" W x 1⅝" H x 7⅜" D. Model **BC 590XLT-T** is a similar version without the 800 MHz. band for only $194.95. Order your scanner from CEI today.

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PR110-T *Regency* "Passport" size radar detector	$114.95
PR120-T *Regency* "micro" size radar detector	$144.95
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MP5510XL-T *Regency* 60 Ch. marine transceiver	$159.95
MP6000XL-T *Regency* 60 Ch. marine transceiver	$209.95
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Regency® RH256B-T

List price $799.95/**CE price $299.95/SPECIAL**

16 Channel • 25 Watt Transceiver • Priority

The *Regency* RH256B is a sixteen-channel VHF land mobile transceiver designed to cover any frequency between 150 to 162 MHz. Since this radio is synthesized, no expensive crystals are needed to store up to 16 frequencies without battery backup. All radios come with CTCSS tone and scanning capabilities. A monitor and night/day switch is also standard. This transceiver even has a priority function. The RH256 makes an ideal radio for any police or fire department volunteer because of its low cost and high performance. A *60 Watt* VHF 150-162 MHz. version called the **RH606B-T** is available for $429.95. A UHF 15 watt, 16 channel version of this radio called the **RU156B-T** is also available and covers 450-482 MHz. but the cost is $454.95.

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The *Uniden* line of Citizens Band Radio transceivers is styled to compliment other mobile audio equipment. Uniden CB radios are so reliable that they have a two year limited warranty. From the feature packed PRO 810E to the 310E handheld, there is no better Citizens Band radio on the market today.

PRO310E-T *Uniden* 40 Ch. Portable/Mobile CB	$83.95
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GRANT-T *Uniden* 40 channel SSB CB mobile	$166.95
MADISON-T *Uniden* 40 channel SSB CB base	$244.95
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PRO510XL-T *Uniden* 40 channel CB Mobile	$38.95
PRO520XL-T *Uniden* 40 channel CB Mobile	$56.95
PRO530XL-T *Uniden* 40 channel CB Mobile	$79.95
PRO540E-T *Uniden* 40 channel CB Mobile	$97.95
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RD25-T *Uniden* visor mount radar detector	$54.95
RD500-T Uniden visor mount radar detector	$74.95

Bearcat® 200XLT-T

List price $509.95/**CE price $254.95/SPECIAL**

12-Band, 200 Channel • 800 MHz. Handheld
Search • Limit • Hold • Priority • Lockout

Frequency range: 29-54, 118-174, 406-512, 806-956 MHz.

Excludes 823.9875-849.0125 and 868.9875-894.0125 MHz.

The *Bearcat* 200XLT sets a new standard for handheld scanners in performance and dependability. This full featured unit has 200 programmable channels with 10 scanning banks and 12 band coverage. If you want a very similar model without the 800 MHz. band and 100 channels, order the **BC 100XLT-T** for only $189.95. Includes antenna, carrying case with belt loop, ni-cad battery pack, AC adapter and earphone. Order your scanner now.

Bearcat® 800XLT-T

List price $549.95/**CE price $259.95/SPECIAL**

12-Band, 40 Channel • No-crystal scanner
Priority control • Search/Scan • AC/DC

Bands: 29-54, 118-174, 406-512, 806-912 MHz.

The Uniden 800XLT receives 40 channels in two banks. Scans 15 channels per second. Size 9¼" x 4½" x 12½." If you do not need the 800 MHz. band, a similar model called the **BC 210XLT-T** is available for $178.95.

Bearcat® 145XL-T

List price $189.95/**CE price $94.95/SPECIAL**

10-Band, 16 Channel • No-crystal scanner
Priority control • Weather search • AC/DC

Bands: 29-54, 136-174, 406-512 MHz.

The *Bearcat* 145XL is a 16 channel, programmable scanner covering ten frequency bands. The unit features a built-in delay function that adds a three second delay on all channels to prevent missed transmissions. A mobile version called the **BC560XLT-T** featuring priority, weather search, channel lockout and more is available for $94.95. CEI's package price includes mobile mounting bracket and mobile power cord.

President® HR2510-T

List price $499.95/**CE price $239.95/SPECIAL**

10 Meter Mobile Transceiver • Digital VFO
Full Band Coverage • All-Mode Operation
Backlit liquid crystal display • Auto Squelch
RIT • Preprogrammed 10 KHz. Channels

Frequency Coverage: 28.0000 MHz. to 29.6999 MHz.

The *President* HR2510 Mobile 10 Meter Transceiver made by Uniden, has everything you need for amateur radio communications. Up to 25 Watt PEP USB/LSB and 25 Watt CW mode. Noise Blanker. PA mode. Digital VFO. Built-in S/RF/MOD/SWR meter. Channel switch on the microphone, and much more! The HR2510 lets you operate AM, FM, USB, LSB or CW. The digitally synthesized frequency control gives you maximum stability and you may choose either pre-programmed 10 KHz. channel steps, or use the built-in VFO for steps down to 100 Hz. There's also RIT (Receiver Incremental Tuning) to give you perfectly tuned signals. With receive scanning, you can scan 50 channels in any one of four band segments to find out where the action is. Order your HR2510 from CEI today.

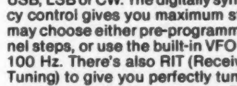
NEW! President® HR2600-T

List price $599.95/**CE price $299.95/SPECIAL**

10 Meter Mobile Transceiver • New Features

Delivery for this new product is scheduled for June, 1989.

The new *President* HR2600 Mobile 10 Meter Transceiver is similar to the *Uniden* HR2510 but now has repeater offsets (100 KHz.) and CTCSS encode.



BC760XLT
800 MHz.
mobile scanner
SPECIAL!

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XE750-T *Uniden* Cordless Phone with speaker	$99.95
XE550-T *Uniden* Cordless Phone	$79.95
XE300-T *Uniden* Cordless Phone	$69.95

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If you purchase a scanner, CB, radar detector or cordless phone from any store in the U.S. or Canada within the last 30 days, you can get up to three years of extended service contract from Warrantech. This service extension plan begins *after* the manufacturer's warranty expires. Warrantech will perform all necessary labor and will not charge for return shipping. Extended service contracts are not refundable and apply only to the original purchaser. A two year extended contract on a mobile or base scanner is $29.99 and three years is $39.99. For handheld scanners, 2 years is $59.99 and 3 years is $79.99. For radar detectors, two years is $29.99. For CB radios, 2 years is $39.99. For cordless phones, 3 years is $34.99. Order your extended service contract today.

OTHER RADIOS AND ACCESSORIES

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BC70XLT-T *Bearcat* 20 channel scanner	$159.95
BC175XLT-T *Bearcat* 16 channel scanner	$156.95
R2060-T *Regency* 60 channel scanner	$149.95
TS2-T *Regency* 75 channel scanner	$269.95
UC102-T *Regency* VHF 2 ch. 1 Watt transceiver	$114.95
BPS5-T *Regency* 16 amp reg. power supply	$179.95
BP205-T Ni-Cad batt. pack for BC200/BC100XLT	$49.95
B8-T 1.2 V AA Ni-Cad batteries (set of eight)	$17.95
FBE-T Frequency Directory for Eastern U.S.A.	$14.95
FBW-T Frequency Directory for Western U.S.A.	$14.95
RFD1-T Great Lakes Frequency Directory	$14.95
RFD2-T New England Frequency Directory	$14.95
RFD3-T Mid Atlantic Frequency Directory	$14.95
RFD4-T Southeast Frequency Directory	$14.95
RFD5-T N.W & Northern Plains Frequency Dir.	$14.95
ASD-T Airplane Scanner Directory	$14.95
SRF-T Survival Radio Frequency Directory	$14.95
TSG-T "Top Secret" Registry of U.S. Govt. Freq.	$14.95
TTC-T Tune in on telephone calls	$14.95
CBH-T Big CB Handbook/AM/FM/Freeband	$14.95
TIC-T Techniques for Intercepting Communications	$14.95
RRF-T Railroad frequency directory	$14.95
EEC-T Embassy & Espionage Communications	$14.95
CIE-T Covert Intelligence, Elect. Eavesdropping	$14.95
MFF-T Midwest Federal Frequency directory	$14.95
A60-T Magnet mount mobile scanner antenna	$35.95
A70-T Base station scanner antenna	$35.95
A1300-T 25 MHz.–1.3 GHz Discone antenna	$109.95
USAMM-T Mag mount VHF ant. w/ 12' cable	$39.95
USAK-T ¾" hole mount VHF ant. w/ 17' cable	$35.95

Add $4.00 shipping for all accessories ordered at the same time. Add $11.00 shipping per radio and $4.00 per antenna.

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CIRCLE 121 ON READER SERVICE CARD

Construction and Alignment

The kit provided by GRAPES includes complete documentation and all parts required to populate the three main boards except for the channel crystals (two are required: one for the transmitter and one for the receiver). I found the kit convenient and easy to assemble, particularly after having built two of the early "bare beta board" versions of the modem when I had to scrounge for my own parts! Nothing was missing, and I had the boards together in a weekend. The location of each part was silk-screened into the RF and receive decoder cards.

Although there was no silk screen on the transmit encoder card (see Figure 5), I had no problem putting everything in its place using the parts placement diagrams.

As mentioned earlier, the modem can operate at speeds other than 56 Kb/s. Dale was careful to place all of the speed-determining components on plug-in DIP headers on the transmit encoder and receive decoder cards, so you don't have to unsolder anything to change speeds.

The bandwidth of the receive IF filter on the RF board is fixed, however, so you'd have to do some soldering and recalibrating there if changing speeds. I don't know of too many people, however, who have operated these boards at speeds below 56 Kb/s!

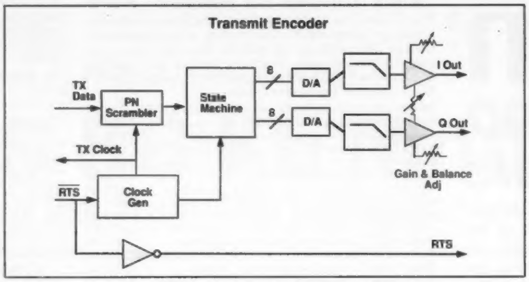

Figure 5. With the parts placement diagrams, it's easy to assemble the transmit encoder.

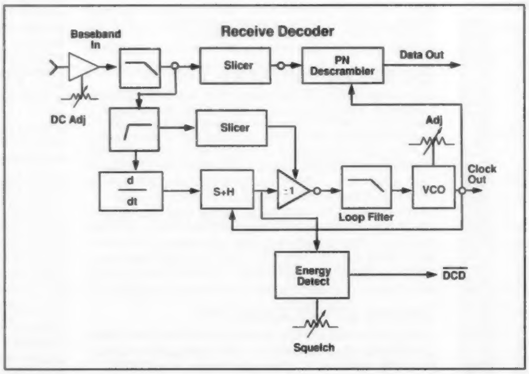

Figure 6. The receive decoder card adjustments are straightforward.

Modem Setup

Alignment of the modem requires an oscilloscope, preferably a dual-trace model. The instructions are fairly clear, and tweaking the transmit encoder card took only a few minutes. The RF card takes a little more work. I was fortunate to have the use of an IFR 1200S Service Monitor to make the alignment of the IF bandpass filter coils in the receiver a two-minute job, but it's not that much harder with just the scope. I did notice something on the IFR's spectrum analyzer while setting the power gain adjustment in the transverter:

If you crank the wick all the way up, the signal sidebands come up noticeably. It's best to sacrifice a few watts to let the transverter have some headroom. The modem signal is a specially modified form of MSK with some deliberate amplitude modulation to reduce the extra sidebands, so you want to operate the transverter in its linear region. If you do this, the spectrum is very clean.

Once the RF board was aligned, the receive decoder card adjustments were very straightforward (see Figure 6). I did have one problem with false triggering in the NE555 IC in the clock recovery circuit (see Figure 7); I fixed this by soldering a miniature 0.1 µF capacitor across the supply and ground pins on the underside of the socket.

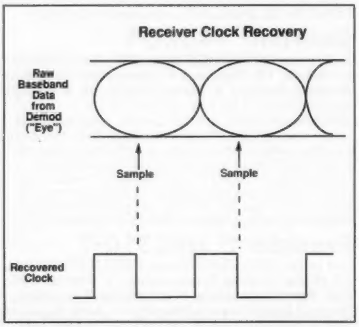

Figure 7. In the clock recovery circuit, the author soldered a miniature 0.1 µF capacitor across the supply and ground pins on the underside of the socket.

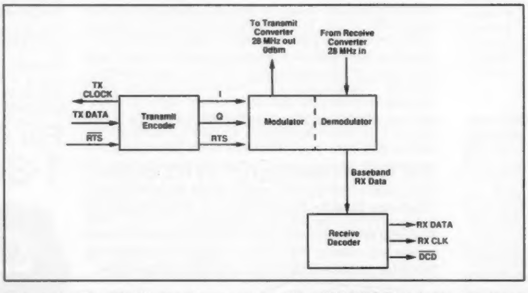

Figure 8. The 56 Kb modem system. The GRAPES kit includes three PC boards: transmit encoder, receive decoder, and RF board, plus all necessary board parts except the channel crystals.

Assembly

The GRAPES kit contains no chassis; you have to find one and drill your own holes. I've been using the 10" x 12" x 2" Hammond aluminum chassis, as I can arrange the boards for easy access to the adjustment screws and test points. You can certainly use more compact (or more attractive!) cabinets, if you prefer.

The modem requires a source of ±5V DC, plus whatever the transverter requires (typically +12V DC). I used some small surplus Japanese-made switching power supplies sold by Radio Shack for the bargain price of $5. This was five years ago, and unfortunately they are no longer available. Suitable AC power supplies are certainly available, but if you prefer 12V DC operation, you can use a linear regulator to generate +5V. The modem's −5V requirements are minimal, so a simple charge pump circuit will do just fine.

Up and Running

This modem challenges you to figure out how to move data to and from your computer fast enough! The early experiments in Atlanta with this modem used modified TNC-2s; the mods consisted of beefing up the digital components (CPU, SIO, memory), eliminating the internal Bell 202 modem, and installing a modified copy of the KISS TNC EPROMs. The TNC was then connected to an IBM PC host computer running my TCP/IP package.

This worked, but the serial link between the TNC and host computer was still not fast enough. The cost was unappealing. But if you're interested, the details are included with the modem kit documentation.

Problems and Adaptations

When I obtained my modems a year ago at Dayton, I also picked up a PCPA (PC Packet Adaptor) card from DRSI (Digital Radio Systems, Inc). The PCPA is a plug-in adaptor card for the IBM PC bus that contains a Zilog 8530 HDLC chip, a Bell 202 modem, and associated "glue" parts. Bypassing the modem and RS-232 drivers (a procedure described in the DRSI manual), I was able to connect the PCPA's 8530 chip directly to the modem with a ribbon cable.

Then I wrote a special software "driver" module for my TCP/IP package that accesses the PCPA's 8530 chip directly, passing data at the full 56 Kb/s rate of the modem. It works, but at a cost: because of the high data rate, the computer has its hands completely full whenever the modem is active, transmitting or receiving. Everything else (keyboard echoing, the time-of-day clock, etc.) momentarily grinds to a halt!

This is not ideal, so work is underway to develop a "smart" card with its own CPU to handle the low-level tasks of talking to a high speed modem, freeing the main CPU for other things. Mike Chepponis K3MC has built a prototype, and my next step is to program it. But until then, we can use the DRSI PCPA and its functional equivalent, the PacComm PC-100. (You can also use a board called the "Eagle card,"once sold surplus by the now-defunct Eagle Computer company, if you can get one.)

Packet in the Fast Lane

It should not surprise you that it's VERY easy to get spoiled by 56 Kb packet! Once you've had a taste, there's no going back. Even my 9600 b/s telephone modem seems slow in comparison, and one wonders how anyone could possibly tolerate 1200 b/s!

But to be fair, 56 Kb is not without its problems.

The first problem is probably fairly obvious: There aren't that many people around to talk to yet! The situation here in Northern New Jersey on 220.55 MHz (the local 56 Kb/s channel) is much like 145.01 MHz was back in 1983. Our 56 Kb network presently consists of KA9Q, WB0MPQ, KA9Q-2 (a digipeater/IP switch) and N2AER; we expect N4HY and N7AKR on the air soon. High speed packet is now at roughly the same stage that 1200 baud packet was in the early 1980s, and with luck it'll become as popular.

The keyup delay required by the WA4DSY modem isn't as small as I would like. We're currently running with transmit delays of about 15 milliseconds. This may seem short until you realize that in 15 ms at 56 Kb/s, you can send 100 characters! Many packets aren't this big, even when you include full TCP, IP, and AX.25 protocol headers.

The data carrier detect (squelch) circuit in the WA4DSY demodulator could probably be improved. Although it works reasonably well (better than the DCD circuits in most slow speed packet modems) it can be tricky to adjust and the threshold sometimes varies due to front end desensing. (Perhaps this is an unfair criticism; I live about 500 feet away from a 220 MHz FM repeater.)

High speed operation requires wide bandwidths. As mentioned, the WA4DSY modem occupies about 75 kHz when running at 56 Kb/s; it is generally operated in a 100 kHz channel. This is about five times the bandwidth of an FM voice channel (20 kHz), so five times as much noise enters the modem receiver's passband as compared to a regular FM voice receiver.

Therefore, the 10 watts of 56 Kb/s RF coming out of my transverter is like 2 watts of FM voice RF—not much. Multipath is also a problem (100 kHz is half as wide as a commercial FM broadcast channel.) Beams and good sites help, but sometimes there is no substitute for a power amp.

An aside: The spectral efficiency of a modem isn't measured by its bandwidth alone, but by the ratio of the bandwidth to the data rate. Although the WA4DSY modem requires five times the bandwidth of a standard 1200 baud packet signal, its data rate is 46.7 times faster. This makes it about 9.3 times more spectrally efficient than the latter.

This wide bandwidth also limits us to 220 MHz and up, both a blessing and a curse. It's a blessing because 2 meters really isn't the proper place for serious packet operation because it's too crowded, at least in densely populated areas like New York. It's a curse because propagation isn't as good on the higher bands, and transverters are more expensive. Nonetheless, we'd better get active there in any event, since spectrum theft by other services can strike at any time. If Docket 87-14 is upheld and we are unable to find 100 kHz of space above 222 MHz, my friends and I are going to have to junk some perfectly good transverters.

The availability of high speed modems, interface cards and host computers does not guarantee maximum throughput; careful network engineering is still necessary. But the WA4DSY modem is a major contribution to amateur packet radio, and it has the potential to be as revolutionary as the original Vancouver and TAPR TNCs. ■

Phil Karn KA9Q works for Bell Communications Research (Bellcore) designing and maintaining internal networks. He is one of the founding fathers of amateur packet radio, as he co-authored the AX.25 protocol specification. Phil is a member of the Board of Directors of the Tucson Amateur Packet Radio (TAPR) group, and is very active in AMSAT. You may contact Phil at 25-B Hillcrest Road, Warren NJ 07060.

"Become Enlightened, Not Lightning'd!"

RC-96 Repeater Controller
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Flash! The RC-96 Repeater Controller two year warranty now includes lightning coverage.

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CIRCLE 1 ON READER SERVICE CARD

Continued from page 32

Parts List

Part	Use	Radio Shack #
Metal Box	Cabinet	270-272
4-Pin Mike Jack	Headset Jack	274-002
4-Pin Mike Plug	Headset Plug	274-001
DB-9 Female (2)	VHF Box Connect HF Cable Connect	276-1538
DB-9 Male (2)	VHF Cable Connect HF Box Connect	276-1537
Phono Jacks (4)	VHF & HF AFSK & PTT	274-346
1/8" Mini Jacks (4)	VHF & HF Audio In/Out	274-251
1/8" Mini Jack (1)	Remote PTT	274-251
3PDT Mini Toggle (2)	NORM/REV & KAM/HS	275-661
DPDT Mini Toggle (1)	NORM/WEFAX	275-663
SPDT Mini Toggle (1)	REC/X MIT	275-662
Mini Shielded Cable	Wiring	278-752

Misc.: Solder lugs, audio cables, dry transfer lettering, clear acrylic spray paint.

slowly. If part of the letter remains on the backing, lower it back to the surface carefully and rub again. You quickly get the hang of it, and they make a project look very professional.

With the lettering done, I sprayed both surfaces with several coats of clear acrylic. Always test the spray first. All the acrylic sprays I have used so far haven't caused problems, but there are some sprays that make the lettering dissolve and run. Spray several light coats with plenty of drying time in between. You don't want any runs on the front panel!

Installing the Ports and Switches

I let the box sit for a night or two, then mounted the switches and connectors. Once they were in place and carefully tightened down it was time to heat up the old soldering iron.

I used miniature coax for the wiring for several reasons, most of them having to do with RFI (We already get enough noise in our transmit and receive signals.) Ground the shield of at least one end of each wired connection in the box. Remember to first make a good mechanical connection with the wire to the solder lug, then make a good solder connection. Keep all leads as short as possible, making them nearly taut.

Adding Accessories

The Telex headset had a commercial plug on it. I could find no markings as to which pin was for the earphones and which was for the mike. Hanging the earphones on my head and using the ohm position of my multimeter, I checked between the center wire and the shield of each wire. I heard the crackle in the phones. That identified the phone wire. The other was obviously the mike. I wired a common four-prong mike plus to the cable to match the four-prong jack on the switch box.

I took time out from the box to install the DB-9 plugs on the KAM cables. I used the diagrams in the KAM instruction manual to identify the wires. Shielded audio cables from my junk box made the PTT and AFSK cables for both HF and VHF. The FT-767GX uses phone connectors for Patch input and PTT input. For the two meter, I stripped one end of the cables and soldered them to a mike connector.

Checkout

I went back over each wire, one at a time, tracing it in comparison to the schematic. I didn't want PTT voltage going into a receive audio circuit or some other IC eater, chewing up my rigs! Satisfied that it was close to correct, I plugged up the cables and gently powered up the devices.

The buzz saw of packet ripped the two meter speaker and text unraveled across the computer screen. One quick fix, and I ran it through the rest of the modes and found one problem. A quick look and then moving one wire to the other side of a switch fixed that one. Even with my second and third recheck, I had missed that one.

It all worked pretty much as I had expected. The headset worked nicely. With a foot switch plugged into the remote PTT jack I could work DX and log with two free hands.

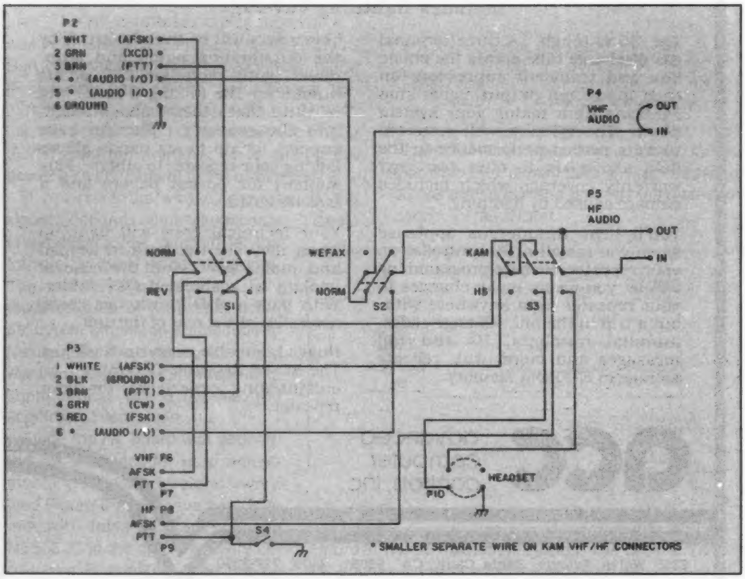


Figure 1. KAM Box schematic. An easy one-afternoon project.

Using the KAM

Photo A shows the front panel. From left to right:

HEADSET JACK	(P10)	
NORM/REV	(S1)	Switches RTTY between HF and VHF.
NORM/WEFAX	(S2)	Switches the HF audio to the VHF port of the KAM for WEFAX.
KAM/HS	(S3)	Switches the HF receive and transmit from the KAM to the headset.
REC/X MIT	(S4)	Switches PTT.

Photo B shows the connectors on the back panel. From left to right:

REMOTE PTT	(P1)	For a remote switch, e.g. foot switch.
VHF DB-9	(P2)	(Female) connects the KAM VHF port to the switch box.
HF DB-9	(P3)	(Male) connects the KAM HF port to the box.
VHF AUDIO IN/OUT	(P4)	Alternative to using the "Y" cables that come with the KAM.
HF AUDIO IN/OUT	(P5)	As above, for HF
VHF AFSK	(P6)	Transmit audio for VHF.
VHF PTT	(P7)	To VHF rig.
HF AFSK	(P8)	Transmit audio for HF.
HF PTT	(P9)	To HF rig.

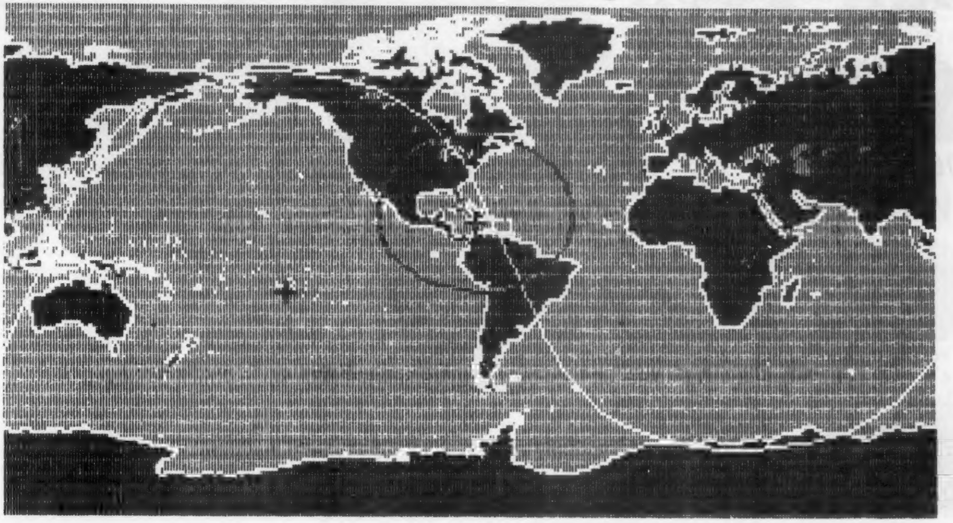
Almost Perfect

After using it for a few days, I decided that on my next box I should add another audio input in the back panel for my scanner. Otherwise, I've got what I wanted. It's nice to switch to WEFAX and tune up and watch the scan and then later drop over onto the RTTY repeater and rag-chew for awhile. And, of course, the KAM excels in packet. All this with just the flip of a switch or two! These alterations have made a very nice operating interface just a little more friendly. ■

Joe Davidson N4AQG has been a ham since 1976, and is especially interested in 10m SSB and FM DXing. Joe currently works as a technical advisor in avionics and tactical radio for the Department of the Army. Other interests include computer hacking and landscape painting with acrylics. You may contact him at 1863 Mount Berry Drive, Douglasville, GA 30135.

Satellite Tracking

with your PC and the Kansas City Tracker & Tuner



The **Kansas City Tracker** is a hardware and software package that connects between your rotor controller and an IBM XT, AT, or clone. It controls your antenna array, letting your PC track any satellite or orbital body. The **Kansas City Tracker** hardware consists of a half-size interface card that plugs into your PC. It can be connected directly to a Yaesu/Kenpro 5400A/5600A rotor controller. It can be connected to other rotor assemblies using our Rotor Interface Option.

The **Kansas City Tuner** is a companion product that is used in satellite work. It can provide automatic doppler-shift compensation for digital satellite work. The **Tuner** is compatible with most rigs including Yaesu, Kenwood, and Icom. It controls your radio thru its serial computer port (if present) or through the radio's up/down mic-click interface.

The **Kansas City Tracker** and **Tuner** include custom serial interfaces and do not use your computer's valuable COMM ports. The software runs in your PC's "spare time," letting you run other programs at the same time.

The **Kansas City Tracker** and **Tuner** programs are "Terminate-and-Stay-Resident" programs that attach themselves to DOS and disappear. You can run other DOS programs while your antenna tracks its target and your radios are tuned under computer control. This unique feature is especially useful for digital satellite work; a communications program like PROCOMM can be run while the PC aims your antennas and tunes your radios in its spare time. Status pop-up windows allow the user to review and change current and upcoming radio and antenna parameters. The KC Tracker is compatible with DOS 2.00 or higher and will run under DESQ-VIEW.

Satellite and EME Work

The **Kansas City Tracker** and **Kansas City Tuner** are fully compatible with AMSAT's QUIKTRAK (3.2) and with Silicon Solution's GRAFTRAK (2.0). These programs can be used to load the **Kansas City Tracker's** tables with more than 50 satellite passes. We also supply assembled & tested TAPR PSK modems with cases and 110v power supplies.

DX, Contests, and Nets

Working DX or contests and need three hands? Use the **Kansas City Tracker** pop-up to work your antenna rotor for you. The **Kansas City Tracker** is compatible with all DX logging programs. A special callsign aiming program is included for working nets.

Packet BBS

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Vision-Impaired Hams

The **Kansas City Tracker** has a special morse-code sender section that will announce the rotor position and status automatically or on request. The speed and spacing of the code are adjustable.

The **Kansas City Tracker** and **Tuner** packages include the PC interface card, interface connector, software diskette, and instructions. Each Kansas City unit carries a one year warranty.

• KC Tracker package for the Yaesu/Kenpro 5400A/5600A controller	$189
• Interface cable for Yaesu/Kenpro 5400A/5600A	$ 19
• Rotor Interface Option (to connect to ANY rotors)	$ 30
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• Assembled & tested TAPR PSK modem with case & 110v power supply	$219
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Packet Radio and High-Tech Nomadics

A sneak preview of the Winnebiko III.

by Steven K. Roberts N4RVE

Steve Roberts N4RVE on the Winnibiko II. The new recumbent, the Winnibiko III, will carry both the PacComm Micropower-2 TNC and the MFJ 1278 multi-mode data controller. Apart from "traditional" packeting, Brian will be a roving PBBS, and use a packet link to remotely control the bike's computer/radio system from a laptop.

If you've been reading *73* for over a year, you've already had a look at the Winnebiko II—the computerized, ham radio-equipped recumbent bicycle that I've pedaled 16,000 miles around the United States. And if you were a regular reader of my article series, you even might have wondered what happened; I've received a few pieces of packet mail asking if I've been run over by a truck.

Well, if I've been struck by anything at all, it's the passion to create new machines. Maggie KA8ZYW and I are currently in a year-long Silicon Valley layover, building all-new bike systems and preparing to hit the road for many years of open-ended international travel. The project has been escalated to a new level, with the design specification now calling for maximum independence from support facilities of any kind. Indeed, this has become an all-out effort aimed at creating a self-maintaining mobile information platform, constantly in communication with worldwide voice and data networks while freely wandering the Earth's surface under human and solar power.

Winnebiko III Architecture

Packet radio is a key component in the system, but before a description of its implementation can make sense, you need a quick look at the whole machine. One disclaimer: This is an overview of work-in-progress, and there may be a few discrepancies between what is stated here and what actually rolls out the door this winter.

There are two major electronic areas in the new machine. Up front in the streamlined console are all computer and control systems, and back in the solar-roofed trailer are the rackmount ham shack and power management hardware. Between the two sit the wetware information system and bio-engine, coupled to the rest of the machine via a variety of interfaces that include a heads-up display, ultrasonic head-position sensor for display control, speech I/O, handlebar keyboard, active Peltier-effect scalp-cooling system, thumb mouse, and random controls. Oh yes—and pedals.

The controller for the whole machine (one level down from the human, that is) is an eminently hackable CMOS 68000 running FORTH. It's in charge of the local area network that connects all other information systems and 68HC11 microcontrollers, as well as a giant "resource bus" based on Mitel crosspoint switches and AMD programmable gate arrays. Through this array pass all audio, serial, power-control and status signals, making it extremely easy to establish connections between subsystems that I might not originally intend to interface. Also in the console system are a pair of DOS environments for AutoCAD, OrCAD, mapping, satellite tracking, text editing, database management, and communications. On top of this there'll be a significant new machine, still proprietary, that I'll reveal in a later article, as well as a dedicated 68HC11 for data collection and a few stand-alone intelligent devices for navigation, speech, and so on.

> ***"The controller for the whole machine is an eminently hackable CMOS 68000 running FORTH."***

All this provides extensive real-time processing horsepower and a very friendly user interface—with a VGA backlit display, a 640 x 200 LCD for the FORTH, a flip-down hi-res screen, and the heads-up display as graphics options. But now that I can compute as much as I want, how do I communicate with the rest of the world?

The trailer system carries the bulk of the radio gear (not including the cellular phone, the 56-kilobaud spread-spectrum data link, a Swintek full-duplex wireless intercom for security monitoring, and an embedded ICOM µ2AT in the console for bike-to-bike chat). The radio gear takes the form of a shock-mounted 19" equipment rack accessible through a fold-down rear door, along with a collapsible antenna mast for the OSCAR-13 array and whips, a permanent 70cm collinear for Microsat operation, and the usual bag of dipoles and accessories.

The rack-mounted gear includes ICOM's new 725 (modified for low-power drain), a pair of Yaesu multimode transceivers for both OSCAR and terrestrial VHF/UHF operation, a pair of ARR preamps, an AEA ATV transceiver, an antenna tuner and coax patch panel, an MFJ/Bencher keyer, a power-entry module for AC line interface to the bike's 12 volt bus, a regenerative braking controller, yet another 68HC11 for trailer data collection and local control, and two of the bike's three main batteries. Maggie's bike, in case you're wondering, carries a Yaesu 290 and Ranger 3500 for 2 meter and 10 meter multimode operation.

But where does packet fit in all this?

Bicycle Datacomm

For the last three years I've been running bicycle-mobile packet via PacComm's first-generation TNC, the bike's computer, and the handlebar keyboard. This has been a fairly low-level manual operation, with a few tentative stabs at maintaining a mobile BBS, but no real autonomy in the datacomm and message-passing realms.

The new system is different, and uses packet in three ways.

First, I carry both a PacComm Micropower-2 and an MFJ 1278 for "traditional" packet radio use. The MFJ multimode unit, modified with all SMOS components to minimize power drain, is for browsing the HF spectrum in search of interesting FAX, RTTY, and AMTOR contacts. The 35 mA PacComm is for 2 meter packet and has a big FET switch on the modem disconnect to accommodate a TAPR PSK demodulator for the Microsats. In both cases, operation is via the handlebar keyboard and any of the display spaces when I'm mobile, or via a laptop when I'm parked.

The difference between mobile and parked operation has spawned the second major packet addition to the system. Last time, the robust machine was my laptop, and the on-board computer was fairly wimpy. With that setup, I had no particular interest in using the bike machine when parked, and happily immersed myself in the H-P system instead. But now the bike's Ampro 286 with a 40-meg hard disk and 4-meg RAMdisk (along with other extensive processing resources) makes carrying a high-end laptop seem a bit unnecessary. The problem, however, is that I don't particularly want to sit on the bike working for hours when I'm not actually riding it.

The solution is simple. A pair of PacComm surface-mount TNCs—one on the bike and one in my backpack—are linked to each other via 2 watt Maxon business-band UHF data radios (which require a separate license). When I'm off the bike, the only hardware left active is this data link and a security system. If I want to access bike resources for any reason, I can flip open the backpack, bring up a communication program, and sign on from up to three miles away.

The first level of response from the bike is the mini-PBBS in the PacComm, which, unlike the typical TNC, lets me send a data packet that writes directly to a parallel port. A keyword does the trick, booting up the 68000 system through a power controller and presenting me with its FORTH command line. I now have full control of the system and can check telemetry data, dial out via cellular phone, boot up the 286 and access a database, power up and operate the ICOM 725, or send speech strings for local output via the Audapter speech synthesizer. The whole bike, except for the wheels, is completely remote-controlled . . . for everything is computer-controlled.

The third major packet application on the Winnebiko III involves the orbiting BBSs scheduled for launch this November—AMSAT's quartet of Microsats. The details will clarify as the system comes together, but preliminary discussions indicate that wherever in the world we travel, my bike will periodically run a satellite tracking program, power up the Yaesu system at the appropriate times, scan with the TAPR demodulator's feedback until the bird is acquired, then automatically exchange text files and upload the latest block of telemetry data (including our precise location derived from GPS satellites). All this will be piped through "mission control" in the States, with the data parsed and retransmitted to other nodes as appropriate. It seems likely that this will become a significant component of my non-business E-mail traffic—and provide a spirited demo of Microsat technology: a guy wandering the world on a bicycle easily tracked to within a few hundred feet from someone's ham shack.

Fellow hams, we have some amazing technology in this subculture of ours!

The PR Component

I'd like to make a quick comment on a related issue. Recent discussion on both wireline and packet nets has revealed the disturbing fact that the new director of the FCC is Sharree Marshall, an ex-employee of the law firm that has represented UPS in its successful bid for the 220–222 MHz portion of the amateur spectrum.

We hams have more of a problem than ever. The days of taking spectrum space for granted are quickly passing, as alluring new technologies compete for consumer dollars. The UPS crisis is just the first obvious loss; there are a lot of people out there (and I know some of them) who want—and will aggressively fight for—our space. We have a few advocates in high places, but not enough, and we can no longer assume that someone will take care of the problem for us.

One contribution that every ham can make is *public relations*. I'm doing some by integrating ham radio into a high-tech, upbeat lifestyle and writing about it for non-ham publications. Others can score PR points by fixing public problems, getting school kids excited, passing traffic to world trouble spots, inventing nifty gizmology and making it clear that it grew out of ham radio, publishing callsigns with technical papers, and generally doing anything possible to bring our *image* into the current century.

Yes, it's all image, just like any other kind of marketing. It may at times seem blatant and artificial, but that's how the world works.

Here's the test: Take an average person off the street, expose him or her to a few minutes of typical repeater chatter and HF commentary about weather and equipment, then pose the question, "Which is the better use of a 2 MHz piece of the spectrum, improving the speed and efficiency of your UPS deliveries or giving these guys more room to talk to each other?" Until that average person springs to our defense with the very arguments we've been making to each other for the last 50 years, we have a problem.

This article is ostensibly about bicycle-mobile packet, so with that timely little diatribe about the future of all this equipment I'm pedaling, I'll close. As the next few months pass, you'll be hearing from me in growing detail about the new systems, until we're finally on the road and on the air again . . . where we belong.

73 de N4RVE

Steven K. Roberts N4RVE, author of *Computing Across America* *and features in 73 Magazine, can be reached at 1306 Ridgeway Ave., New Albany IN 47150.*

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Improve your TNC's DCD circuit

Make your DCD faster and more discriminating.

by Eric Gustafson N7CL

Proper data carrier detection (DCD) is one of the most important items to consider on any multiple access packet channel. The DCD circuitry for nearly all currently available TNCs are deficient for use on a radio channel. Some are better than others, but most can be dramatically improved. This article shows you how to do just that!

Purpose of DCD

The DCD's main function in the TNC modem is to prevent transmission on an occupied channel. If two stations transmit at the same time, a collision occurs, which corrupts the data, which means both stations have to re-send the data. This increases the total load on the channel and reduces throughput for everyone.

What's the optimum DCD circuit for packet radio? It should have these five key features: It must reliably distinguish information from noise; it must transmit packet data uninhibited by an open squelch; its signal should remain valid through momentary fades or collisions; it should tolerate signal level differences; and it must be fast.

The last item is most important. Most current TNCs rely on the rig's squelch to keep noise out of the modem. Many squelches, however, open very slowly. During that time, the TNC may decide to transmit even though someone else has started using the channel.

Existing Methods

There are two principal ways TNCs detect a data carrier on the channel—phase correlated DCD and total audio power based DCD. The first type is inexpensive and easy to use, and is of two primary types. One looks for phase correlated signal power in the audio presented to the demodulator; the other, applied after the data decision, looks for regular transitions in the data stream emerging from the demodulator. A good example of the use of this second type of circuit is the K9NG 9600 bps modem. (For more information, see "Modifying the Hamtronics FM-5 for 9600 bps Packet Operation," by Steve Goode K9NG, in the ARRL Amateur Radio Fourth Computer Networking Conference, pages 45–51.)

The TAPR TNCs use the output of the in-phase channel phase detector of the phase locked loop (PLL) in an XR2211 demodulator to look for power in the incoming audio that is in phase with the tracked FSK signal.

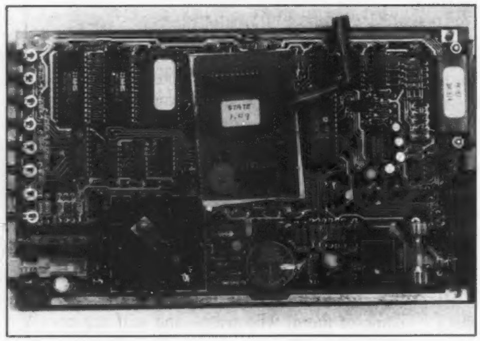
Photo A. The state machine DCD circuit prototype.

Audio signal components (noise) in quadrature phase relation to the tracked signal do not contribute any average power to the detector output signal. This type of detector has a dramatically reduced sensitivity to noise.

The total power based DCD circuit, based on total audio power going to the demodulator, simply measures the total energy in the modem passband. It assumes any signal is a data signal. These circuits are appropriate only for telephone systems which are usually very quiet in the absence of the desired signal.

Either of the two-phase correlated DCD methods is far superior to the total power methods in the radio environment. Both have the ability to reliably indicate the presence of a data carrier, while being able to ignore high amplitude noise that may be present when the desired signal is absent. This characteristic is important because an unsquelched FM receiver typically produces "pink" audio noise whenever the signal is absent. This noise is considerably higher in amplitude than the desired signal.

Apart from the MFJ-1278, I am not aware of any ham packet TNCs that have modems with DCD circuits optimized for the radio environment.

Modifying Popular TNCs

It's not hard to make a DCD circuit that operates in accordance with the above points. If you have a TNC that uses either the

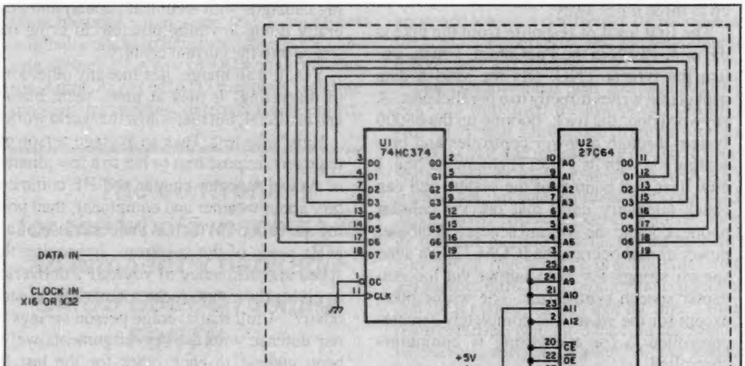

Figure 1. Improved DCD circuit.

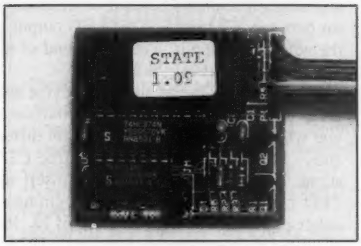

Photo B. The TAPR state machine DCD kit.

AMD7910 or the TCM3105 single chip modem, or if you have a TNC that uses a modem based on audio filters like the PK-232, you can vastly improve the DCD performance of your modem for packet radio. These units all rely solely on total signal power with NO phase correlation as a basis for the DCD decision. The circuit in Figure 1 gives a phase correlation based DCD with "hang" for these TNCs.

How It Works

The DCD circuit presented here is based on the update signals in a digital phase locked loop (DPLL), which recovers both baud clock and data from an NRZI packet data stream. Its output represents detection of baud clock phase correlation with the transitions in the demodulator output data stream.

The circuit consists of the state machine that TNC-2 uses along with some delay elements used to make the DCD decision. The 74HC374 and the 27C64 chip form the state machine. The 74HC14 is used as a pair of retriggerable delay elements, and for signal inversion and buffering. Paul Newland AD7I originally wrote the state machine code used here and in the TNC-2s.

You can get the 27C64 with the state machine code already burned into it directly from TAPR. This same code is in the state machine ROM in any full TNC-2 clone using the XR2211 demodulator and Z80 SIO. If present in the TNC, it will be labeled "STATE 1.09."

One of the state machine signals (which was not used in the TNC-2) appears on pin 19 of the 27C64. This signal is the DPLL update pulse. As long as the DPLL is correctly locked to the incoming data, no pulses appear on this pin. When the DPLL is not locked to an incoming data stream, a continuous stream of pulses appear on it.

This circuit uses the DPLL update signal to retrigger the first delay element so that it never times out when DPLL update pulses are present. If the pulses disappear, the delay element times out and generates the DCD signal.

The output from the first delay element keeps the second delay element triggered so long as DCD is true. When DCD goes false, the second delay element begins a time-out sequence that keeps the DCD output true until the time-out period expires. This is the source of the DCD "hang time."

While the circuit here is mainly intended for 1200 baud VHF FM operation, it also works well for 300 baud HF packet work. If you're on 300 baud HF packet, you'll have to increase the time constant of the "hang" generator (0.47 µF cap) to about 2 µF. The time constant optimum for the DCD generator (the 0.1 µF cap in Figure 1) depends on a number of factors, including the bandwidth of the radio used ahead of the modem.

Pick a value for the DCD generator delay capacitor that produces about a 10 percent duty cycle of false DCD ON time, while monitoring receiver noise on a channel that is *absolutely* free of *any* signals falling within the demodulator's passband. This value will probably be two to four times the 0.1 µF value used for 1200 baud.

Both negative true and positive true DCD outputs are provided so you can use the polarity your TNC requires. Also, JMP1 and JMP2 let you configure the DCD circuit to operate correctly from either a positive or negative true CD output from whichever modem chip your TNC has.

Build the circuit in Figure 1 on as small a piece of perf board as possible. You can then interface it to the TNC and mount it to one of the large chips with double-sided foam sticky tape. Photo A shows the original prototype of this circuit, mounted in a PK-87.

TAPR has a kit available to ease this mod. The kit costs $17.50.(Tucson Amateur Packet Radio P.O. Box 22888, Tucson AZ 85734-22888) Photo B shows an assembled TAPR state machine DCD kit circuit board.

TNC Signals

Once you've built the DCD circuit, you need to obtain some signals from your TNC for the new DCD circuit to use. You'll also have to arrange for the output of this circuit to

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High pitched audible alarm. Operates on 3 - 20 Vdc @ 20 ma. 1" high x 7/8" dia. P.C. board mount.
CAT# PBZ-84 $1.75 each

WIDE BAND AMPLIFIER
NEC# UPC1651G. 1200 Mhz @ 3 db. Gain: 19db @ 1-[illegible] hz. 5 volt operation. Small package 4mm dia. X 2.5 mm thick.
CAT# UPC-1651 2 for $1.00
10 for $4.50 - 100 for $35.00
N-CHANNEL MOSFET
IRF-511 TO-220 case
CAT# IRF 511
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LARGE QUANTITY AVAILABLE

SWITCHES
ITT PUSH BUTTON
ITT MDPL series. 3/4" X 1/2" gray rectangular key cap. S.P.S.T. N.O. Push to close. RATED: 0.1 amp switching, 0.25 amp carry current. P.C. mount. CAT# PB-8
65¢ each • 10 for $6.00 • 100 for $50.00
10 POSITION MINI-ROTARY
Grayhill# 56P36-01-1-10N-C
Mini rotary switch. Non-shorting. 1 deck, 10 positions. .125" dia. shaft X .375" long. .377" behind the panel depth. P.C. pins.
CAT# MRS-10 WAS $2.50 NOW $1.50 each
SPDT PUSHBUTTON
Marquardt# 1843
Rated 6 amps @ 125/250 Vac. Black plastic pushbutton. Switch body: .92" X .94" X .65".
CAT# PB-18 $1.65 each • 10 for $1.50 each
PUSHBUTTON SWITCH
GC/Thermend# 35-420
S.P.S.T., normally open momentary push-button switch. Red plastic actuator .57" dia. Chrome bezel .68" diameter. Threaded bushing mounts in .50" diam. chassis hole. Rated 3 amp @ 250 Vac. Solder lug terminals.
CAT# PB-20 $1.00 each

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12 VOLT D.C. COIL S.P.D.T.
Omron# G2E-184P 4 Amp contacts 335 ohm coil. Sugar cube size. .61" X .42" X .44" high. P.C. mount with pins on DIP spacing.
CAT# RLY-787 $1.50 each
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Gould, Allied Controls SR-1A-5VDC SPST-normally open SIP reed relay. 95 ohm coil. 2 amp contacts. .9" X .26" X .38" high. Housing resists fluorocarbon and chlorinated commercial solvents.
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CAT# NCB-D

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Secondary: 600/600 ohm
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be substituted for the normal DCD signal the TNC uses.

DCD circuit operation requires the following signals:

1. A sample of the data the demodulator recovered in the modem.
2. A sample of a clock that has a frequency of either 16 or 32 times the baud rate.
3. The intercepted carrier detect (CD) signal from the modem. This is the CD the modem generated based on amplitude of the input audio.
4. A source of +5 volts. If you use all CMOS parts, current requirements are minimal. The 74HC14 MUST be a CMOS part for the circuit to work properly.
5. Ground. If your TNC has a provision for a TAPR-style modem disconnect header, it can easily locate and conveniently interface these signals (including the X16 or X32 baud clock) at this header. If it doesn't have this header, you'll need to fish around in the circuit of your TNC to find them. In any case, you will have to disconnect the DCD signal currently used in your TNC and reroute it through the new circuit.

Standard Header Signals

The signal locations on the TAPR standard modem disconnect header are as follows:

1. Receive data is obtained from header pin 18.
2. Carrier detect is obtained from header pin 2.
3. Data carrier detect (DCD) is inserted at header pin 1. Jumper from header pin 1 to header pin 2 is removed.
4. The baud clock is obtained from header pin 12. The frequency of this clock will be either 32 or 16 times the baud rate, depending on whether you have a TNC-1 or one of two types of TNC-2. No changes are necessary to use either clock speed.

AM7910 and TCM3105 Connections

The signals of interest on the AMD7910 modem chip are:

1. Receive Data output (RD)—pin 26.
2. Carrier Detect (CD)—pin 25. (This signal is negative true for the 7910 chip.)

The signals of interest on the TCM3105 modem chip are:

1. Receive Data output (RXD)—pin 8.
2. Carrier Detect (CDT)—pin 3. (This signal is positive true for the 3105 chip.)
3. In TNCs that use the TCM3105 chip, but do not provide another source of the baud clock like the Kantronics KAM, you can use the signal at pin 2 of this chip. This signal is very close to 16 times the baud rate (19.11 kHz instead of 19.2 kHz for 1200 baud).

AEA PK-87

It's easy to interface the new DCD circuit to the PK-87. You don't have to switch back to the internal DCD circuit once you install the mod.

The data signal comes from the center pin of JP4, and the carrier detect signal from the end of JP5, which connects to the modem chip. Insert the DCD output signal from the new circuit at the center pin of JP5, and use the *negative true* output. Remove the jumper originally installed at JP5. The DCD indicator on the front panel will show the action of the new DCD circuit.

The X32 baud clock signal comes from pin 13 of U20 (a 74LS393 divider). Don't be tempted to get this signal from the "clock" line on J4, the external modem connector, as this is an X1 clock.

AEA PK-232

This data controller is also easy to interface to the new circuit. The receive data signal is at the center pin of JP4, and the carrier detect signal at the end of JP6, which is NOT connected to pin 3 of the external modem connector. The X32 baud clock signal comes from pin 13 of U8 (also a 74LS393 divider).

Insert the DCD output from the new circuit at the center pin of JP6. Use the *negative true* output. Then remove the jumper originally installed at JP6.

To use the new DCD circuit with a PK-232 on VHF 1200 baud FM:

1. Set the audio level from the radio so that the tuning indicator "spreads" fully on the station with the lowest transmitted audio level on the channel.
2. Set up the DCD threshold control so that the DCD indicator LED on the front panel lights up whenever there is ANY signal or noise input to the TNC from the radio. Be sure that even the station with the lowest amount of audio on the channel lights this LED. This LED should go out when there is no audio input from the radio (dead carrier from repeater, for example).

If you want to see the action of the DCD signal that the new circuit generates, add a high efficiency LED and 1k series resistor between +5 volts and the LED output of the new DCD circuit. The anode end of the LED should go toward +5 volts.

Thanks to AEA, who recently provided for the detection of a DCD fault condition (usually improperly set threshold control) in the PK-232 TNC software. If you have an older PK-232, contact them for the ROM upgrade.

Pac-Comm TINY-2

The Pac-Comm TINY-2 hooks up as follows:

The X16 baud clock signal is at U10, pin 1.

Receive data is at J5, pin 17.

Negative true carrier detect (CDT) is at J5, pin 2.

Note: This is an inverted version of the CD output from the TCM3105 chip itself. Since this is a negative true logic signal, JMP1 on the new DCD circuit will be used instead of JMP2, which would normally be used for a TCM3105.

Negative true DCD from the new circuit is applied to the TNC at J5 pin 1. Remove the connection between J5 pins 2 and 1. The existing DCD indicator LED will not show the action of the new circuit.

If you want to observe the action of the DCD signal that the new circuit generates, add a high efficiency LED and 1k series resistor between +5 volts and the LED output of the new DCD circuit. The anode end of the LED should go toward +5 volts.

If you want to observe the action of the new DCD circuit on the existing LED indicator, you will have to do the interface a bit differently. First, you get the negative true CDT signal from pin 1 of JPD. Then insert the LED output signal from the new circuit at either pin two of JPD or pin two of J5. Remove the jumper currently installed at JPD on the TINY-2 circuit board. Early versions of this unit may not have JPD. If the new circuit is interfaced in this manner, you can no longer use the "RFDCD" signal. (This is no great loss, however, as it will also no longer be necessary.)

Kantronics KAM

The KAM design makes it impractical to correct the behavior of the DCD circuit of the 300 baud modem. For 1200 baud operation, these are signal location points of interest:

The receive data (RXD) signal is at pin 8 of the TCM3105 modem chip.

The X16 baud clock signal is at pin 2 of the TCM3105.

The positive true carrier detect (CDT) signal from the modem is at pin 3 of the TCM3105. This line from the modem to the CPU is labeled with two numbered pads (7 and 8), which represent pin numbers on a 20-pin modem disconnect header physically similar to, but electrically dissimilar to, the standard TAPR modem disconnect header. You should use JMP2 on the new DCE circuit to break the connection between these two locations.

The DCD output from the new circuit is injected at pin 21 of the 63B03 CPU. The front panel LED that normally indicates CDT signal activity will show the action of the new DCD circuit.

Conclusion and Thanks

This article describes desirable characteristics in a TNC's DCD circuit. The modification instructions enable owners of most TNCs to upgrade their units.

I would like to express appreciation to those who helped with this project. Many thanks to Lyle Johnson WA7GXD, who converted the prototype designs to printed circuit boards for the TAPR kits. This will save many people a lot of effort in performing the conversion on their TNCs. My thanks to Mykle Raymond N7JZT, who built the perf board prototype of the state machine DCD circuit. This prototype was used to tune the values of the delay timers. He also volunteered his PK-87 for testing. And thanks to Dan Morrison KV7B, who proofread the article and provided much useful technical advice. ■

Contact Eric Gustafson N7CL at 2018 S. Avenida Planeta, Tucson AZ 85710. See the follow-up to this article—Improving DCD in XR2211 based TNCs—in an upcoming issue of 73.

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TexNet Packet-Switching Network

An overview of a highly successful and efficient packet radio network.

by Greg Jones WD5IVD

Conceived by Tom McDermott N5EG and Tom Aschenbrenner WB5PUC in the summer of 1985, the Texas network began as a small summer project. One year later, the result was TexNet—an inexpensive, multi-resource, four-port, high-speed "backbone," datagram-based amateur packet switching system. TexNet allows Texas packet radio operators to communicate effectively over distances of several hundred miles in real time, and is currently believed to be the longest and fastest 9600 baud amateur network in the United States (see Figure 1).

System Definition

TexNet, a datagram-based network, acknowledges packets at each step of the path, operates with minimal time delay, and provides user services as well as information about network operations. Operation is at 9600 baud on 450 MHz, with typical local user access at 1200 baud AFSK on two meters or 220 MHz. If necessary, inter-node trunks can run at any of the lower speeds, and the primary or secondary user port will support other baud rates and modulation techniques.

The system is completely compatible with both versions of the AX.25 protocol specifications for user connections. The network itself communicates between its own nodes using AX.25 as the data-link layer two protocol and TEXNET-IP as the layer three network protocol. The TEXNET-IP protocol adds only five bytes of overhead to the front of every packet inside the network.

TEXNET-IP is transparent to all users because the entry and exit nodes translate the users' packets to TEXNET-IP and back again (see Figure 2). The terminating nodes during a user connection maintain tables that specify how each user is connected.

The purpose of an intermediate node is to perform transit-routing only. A TexNet node operates with no fixed routing assignments; a node's routing table is generated upon startup and updated as new nodes begin operations or as current nodes are reset. This allows a node to maintain primary and secondary routing to all other nodes in the network (the user command ROUTE describes this in more detail). TexNet supports 255 nodes per network using the same network ID, and there are 255 network IDs available.

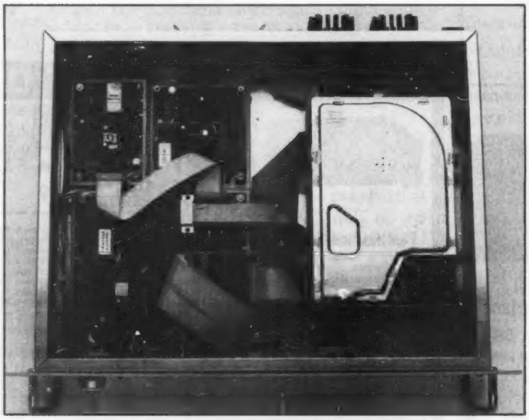

Photo A. Top view...

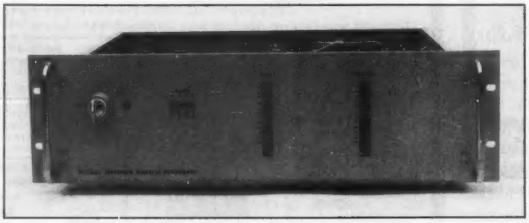

Photo B. ... and front panel of a TexNet Network Control Processor. Michigan TexNet Node constructed by Jay Nugent WB8TKL.

Hardware

The heart of a TexNet node is a partitioned PC board composed of the NCP (node control processor), a 9600 baud TPRS (Texas Packet Radio Society) FSK modem, and a 1200 baud AFSK modem. (Figure 3 shows a block diagram of a TexNet node configuration.) The third port is left free for the attachment of any kind of modem (land-line, 2400 baud, PSK). The 1200 baud AFSK modem is similar to the TAPR TNC-1 modem. The 9600 baud FSK modem is a redesigned K9NG modem, with improved receive filters. The NCP unit contains a Z80A CPU operating at 4 MHz, 32K EPROM, 40K RAM memory, two SIO/0 serial communications ICs for the serial HDLC ports, and a CTC.

Careful design in both software and hardware was necessary to allow all three ports to run at 9600 bps. TPRS decided to develop its own board to keep the cost down and to include two special circuits, a reliable crystal oscillator and a fail-safe state machine called "fire code." Fire code is an EPROM-based logic circuit that monitors the IP data and clock lines (completely independent of the processor and communications ICs) for the presence of a 72-bit unique sequence commanding the node to reset. This 72-bit sequence is programmed into the EPROM along with its state machine. The mean time between false activation is calculated to be considerably more than one million years.

The local console port on the NCP supports the local console, control points, and weather interface. The control points let the node control and monitor status items connected to the node. Some of the uses for control points are to check the status of emergency power at site, to check if the power level of batteries is too low or too high, and to turn devices on and off.

A TexNet daughterboard lets the NCP interface with an optional Winchester hard disk controller. The daughterboard supports the hard disk feature, that in turn supports the packet message server (PMS) and weather feed. The daughterboard also supports additional control points. The local console weather input allows data from the National Weather Service to be fed in at either 1200 bps RS-232 or 75 baud Baudot; this data is then stored on the PMS.

The other key aspect of how well the hardware operates is not the TexNet hardware, but the backbone radio. The performance of

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SIMPLEX PATCH AVAILABLE

VCS-2100
VOX CONTROLLED SAMPLING INTERCONNECT

The Interconnect Specialists Inc. (ISI), VCS-2100, uses a combination of VOX control from telephone line audio, and sampling of receiver noise, to achieve the optimum control method for a simplex interconnect. No sampling interruptions occur during normal conversation. Turn-a-round beeps make operation very smooth and easy.

The VCS-2100 features the ISI exclusive, Automatic Setup. This feature eliminates the trial and error method of sample window setup. Our Quick Start Set-up procedure gets the VCS-2100 up and running, without complicated programming. The VCS-2100 is superior to any other interconnect in its price range. It is a plug-in replacement for the popular 510SA Smart Patch.

FEATURES:

- **AUTOMATIC SET-UP**
  Automatically sets the sample window for your transceiver. No more trial and error.
- **TURN-A-ROUND BEEPS**
  Sends beep to telephone line, and to mobile indicating it's their turn to talk.
- **USER PROGRAMMABLE CW ID**
  CW ID can be programmed using DTMF. ID can be programmed to be sent at the beginning, the end, both, or not at all.
- **AUTOMATIC BUSY DISCONNECT**
  Automatically disconnects if the telephone number dialed is busy.
- **HOOK-FLASH**
  Used to make a second call without disconnecting and re-connecting. Also can be used for phone company services which use Hook-flash.
- **CALL WAITING**
  If a mobile call is attempted and the line is in use, a beep is sent to the phone line indicating that the mobile wants to make a call. Then when the line becomes available, a ring-out is transmitted to the mobile.
- **RING-OUT (REVERSE PATCH)**
  Can be programmed to ring-out one time, on each ring, or not at all, when the line rings.
- **SINGLE OR MULTI DIGIT CODES**
  Connect or disconnect codes can be single * and #, or * and # plus two digits.
- **CALL LIMIT TIMER**
  Can be set for 3, 4, or 5 minutes, or disabled. Can be programmed to reset with *.
- **MOBILE ACTIVITY TIMER**
  Causes disconnect if mobile drives out of range. Can be set to 30, 45, 60, or 90 seconds.
- **TOLL RESTRICT**
  The first digit dialed cannot be a "1" or a "0". Rearms after dialing is complete.
- **PHONE LINE IN USE INHIBIT**
  Prevents interrupting a call when the patch shares the telephone line with a telephone.
- **TOLL RESTRICT DEFEAT CODE**
  A special programmable code allows toll calls. Also allows access to line, even if line is in use.
- **TONE OR PULSE DIALING**
  Switch programmable for Tone or Pulse dialing. Pulse dialing can be used on a tone line.
- **HALF DUPLEX MODE**
  The VCS-2100 can be used as a repeater interconnect in this mode.

Kenwood Compatability with VCS-2100. All connections, required for installation are available at the MIC. connector on most late model Kenwood Transceivers. Interface cables are available from I.S.I.

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1215 N. CR 427, Suite 105 • Longwood, FL 32750
PHONE 407-332-0533 • TOLL FREE 800-633-3750

CIRCLE 100 ON READER SERVICE CARD

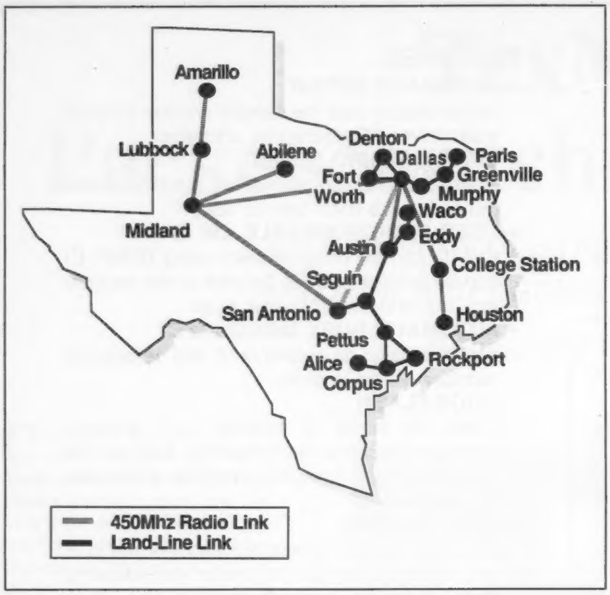
Amarillo
Lubbock
Abilene
Midland
Denton
Dallas
Paris
Fort Worth
Greenville
Murphy
Waco
Eddy
Austin
College Station
Seguin
San Antonio
Houston
Pettus
Alice
Rockport
Corpus
450Mhz Radio Link
Land-Line Link

Figure 1. Texas TexNet map.

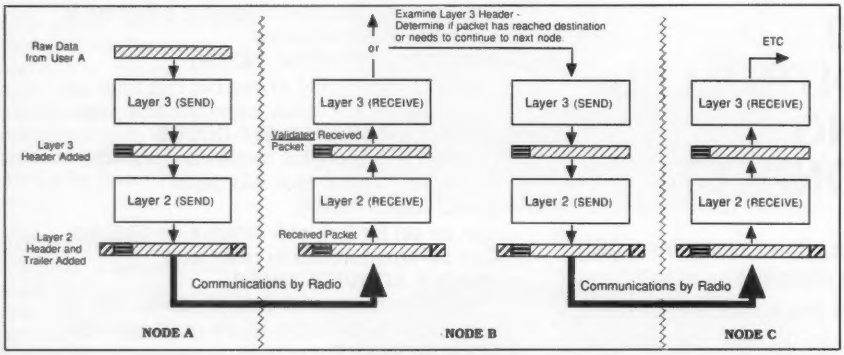
Raw Data from User A
Layer 3 (SEND)
Layer 3 Header Added
Layer 2 (SEND)
Layer 2 Header and Trailer Added
Communications by Radio
NODE A
Examine Layer 3 Header - Determine if packet has reached destination or needs to continue to next node.
or
Layer 3 (RECEIVE)
Validated Received Packet
Layer 2 (RECEIVE)
Received Packet
Layer 3 (SEND)
Layer 2 (SEND)
NODE B
Communications by Radio
ETC
Layer 3 (RECEIVE)
Layer 2 (RECEIVE)
NODE C

Figure 2. TexNet-IP layering.

the network trunk is critical to the throughput of the entire network. TPRS decided to operate TexNet trunks at 9600 baud, with rapid transmit/receive (T-R) switching. At 9600 baud, packets take relatively little time, and thus make the delay time of the radio between transmit and receive the critical factor. Commercial radios exist that fit this criteria, but they require modifications. The amateur radio community should see continued development of packet radios that will work better for higher speed digital communications, thus making the radio component easier to deal with.

TexNet Software

The most important aspect of TexNet is its software, which provides its services, switching, and user interface. In addition to access to the network, each TexNet node provides several services though secondary station IDs (SSIDs).

- SSID-0: digipeater.
- SSID-2 and 3: conference bridge. Each node maintains two independent conference bridges. Transmitted packets are sent to all other users connected to the conference bridge, providing full protocol protected roundtable communications.
- SSID-4: network access.
- SSID-5: local node console.
- SSID-7: packet message server mailbox, for off system forwarding.
- SSID-8 and 9: crossband digipeating.

Connecting to TexNet (SSID-4) presents you with the simple TexNet network interface, that provides a straightforward way of using the network. All you see is data going in and out of the node. Upon connect, you see:

```
CMD > ***CONNECTED TO WR5C-4
WR5C-4 Virtual Connection 07 at 17:04:57
on 10/1/89
*** Welcome to TexNet V0808-WB5PUC
***
Network CMD ? (Enter H for Help)
```

At the network prompt, the commands can be typed in completely or their first letter can be used.

User Commands

HELP lists commands. A few typical commands follow: LOCATIONS SERVED CONNECT W5ABC @, LOCATION CONNECT W5ABC VIA W5DEF @ LOCATION, CONNECT CQ @ LOCATION STATISTICS @ LOCATION, STATISTICS YESTERDAY @ LOCATION MESSAGE, and WEATHER BYE.

BYE disconnects you from the network.

LOCATIONS returns a table, listing all nodes on the network by name.

CONNECT makes connections across the network. An example connect command is CONNECT WB5VZL @ AUSTIN. TexNet at that point takes over; the connect request packet is sent to the node named Austin, and that node attempts to connect to WB5VZL.

If the network node, Austin, makes the connection, the originating user sees YOUR CONNECTION IS ESTABLISHED. The receiving station, WB5VZL, will see ***CONNECTED TO WA5LHS-4. (The WB5VZL TNC shows a layer two connection and the callsign of the Austin TexNet node.) Then WB5VZL in Austin will see *** LINKED TO WD5IVD AT NDALLAS VIA TEXNET. At this point, the two users are operating as if in simplex and the network maintains the connection automatically.

If the connection is not made, the originating user will see REMOTE USER NOT RESPONDING. If WB5VZL in Austin were out of range of the network node but could be reached via a digipeater, then the circuit request

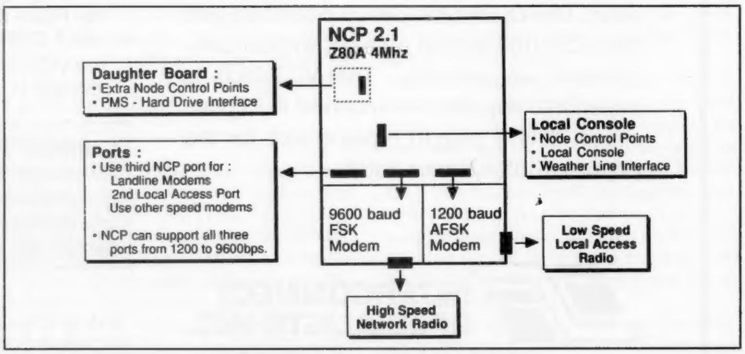
NCP 2.1
Z80A 4Mhz
Daughter Board :
• Extra Node Control Points
• PMS - Hard Drive Interface
Local Console
• Node Control Points
• Local Console
• Weather Line Interface
Ports :
• Use third NCP port for :
Landline Modems
2nd Local Access Port
Use other speed modems
• NCP can support all three ports from 1200 to 9600bps.
9600 baud FSK Modem
1200 baud AFSK Modem
Low Speed Local Access Radio
High Speed Network Radio

Figure 3. Block diagram of a TexNet node.

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80 MTR receiver kit HR-8 **$24.95**
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40 MTR QRP kit QRP-40 **$29.95**
80 MTR QRP kit QRP-80 **$29.95**
Case kit CQRP **$12.95**

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Hear exciting aircraft communications—picks up planes up to 100 miles away. Receives 110—136 MHz AM air band, varactor tuned superhet design with AGC, ceramic filter and adjustable squelch. Runs on 9V battery, 50 mw audio output, 1 μv sensitivity. Optional matching ABS plastic case lets you take it anywhere, features screened graphics and machined aluminum knobs for a real professional look. Compact—great for airshows or for just plain hanging around the airport.

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Receiver case kit, CAR-1 **$12.95**

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A fantastic receiver that captures the world with just a 12" antenna! Receives 4—11 MHz in 2 MHz bands, varactor tuned, superhet design with AGC, RF gain control, and 50 mw audio output. Uses new Signetics mixer chip for less than a microvolt sensitivity, runs on 9V battery. This is a fascinating scout, school or club project, and will provide hours of fun even to the most serious DX'er. Add the optional case kit and you have a real nice looking shortwave set.

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Sensitive superhet FM receiver tunes any 5 MHz segment of band. Listen to ham operations, high band police calls, weather or mobile phone calls! Easy to build receiver features varactor tuning, IC mixer stage, ceramic IF filters and dual conversion design with adjustable squelch. Less than 1 μv sensitivity, runs on 9 V battery, with 50 mw audio output. Optional ABS case with screened graphics and machined aluminum knobs provide a nice professional look.

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10 MTR kit FR-10 **$29.95**
220 MHz kit FR-20 **$29.95**
Receiver case kit CFR-7 **$12.95**

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A sensitive all purpose preamp, ideal for scanners, TV sets, VHF, UHF rigs, counters, etc. Features low noise, 4 db NF, 20 db gain, 100 KHz—1 GHz operation. Runs on 9—12 VDC, 50 ohms input.

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Transmits modulated infrared light up to 30 feet without lenses, up to 1/4 mile using lenses. Uses 30 KHz carrier for hum-free operation, transmits thru windows, etc. Ideal for "bugs" or listening to IR remote controls. Transmitter has sensitive mike input, receiver uses PIN detector and drives speaker output. Units operates on 9—12 VDC.

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The PR-2 is ideal for measuring weak signals from 10 to 1,000 MHz • flat 25 db gain • BNC connectors • great for sniffing RF • ideal receiver/TV preamp • 3 db NF

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A super high performance FM wireless mike kit! Transmits a stable signal up to 300 yards with exceptional audio quality by means of its built in electret mike. Kit includes case, mike, on-off switch, antenna, battery and super instructions. This is the finest unit available.
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$139.95 WIRED, INCLUDES AC ADAPTER

CT-90 9 DIGIT 600 MHz

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CT-50 8 DIGIT 600 MHz

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CT-125 9 DIGIT 1.2 GHz

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Tilt bail for CT-70, 90 & 125	3.95
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MODEL	FREQ RANGE	SENSITIVITY	ACCURACY	DIGITS	RESOLUTION	PRICE
CT-70	20 Hz-550 MHz	< 50 mv To 150 MHz	1 PPM	7	1 Hz, 10Hz, 100Hz	139.95
CT-90	10 Hz-600 MHz	< 10mv To 150 MHz < 150mv To 600 Mhz	1 PPM	9	0.1Hz, 10Hz, 100 Hz	169.95
CT-50	5 Hz-600 MHz	LESS THAN 25 mv	1 PPM	8	1Hz, 10Hz	189.95
CT-125	10 Hz-1.25 GHz	< 25mv @ 50 MHz < 15mv @ 500 MHz < 100mv @ 800 MHz	1 PPM	9	0.1Hz, 1Hz, 10Hz	189.95
CT-90 WITH OV-1 OPTION	10 Hz-600 MHz	< 10mv To 150 MHz < 150mv To 600 MHz	0.1 PPM	9	0.1Hz, 1Hz, 10Hz	229.00

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PHONE ORDERS CALL
716-924-4560
FAX 716-924-4555

RAMSEY ELECTRONICS, INC. 793 Canning Parkway, Victor, NY 14564 string would read C WB5VZL V DIGI @ AUSTIN.

TPRS hopes that a definition and adoption of an inter-network or user-to-network interface standard within the amateur community will soon be agreed upon.

Connections through the secondary user ports are also possible. You can force a connection request through a port other than the primary user port by appending a comma and the physical channel number to the node name. C W5ABC @ NDALLAS,2 would force the connection request through NDALLAS's second user port.

Port zero is defined as the network backbone. Port one is the primary user port, typically 1200 baud on two meters. The user ports can be 1200, 2400, 4800, 9600, or whatever baud the NCP board has been strapped for. Modulation depends on the modem in use. Port two can be an alternate user port or an alternate network trunk.

CONNECT CQ @ NODE is used to broadcast a CQ call over a remote node. C CQ @ AUSTIN, for example, transmits CALLING CQ CQ CQ FROM WD5IVD-0 @ NDALLAS from the Austin node.

The MESSAGE command connects you to the packet message system (PMS) module. The network automatically routes and connects you to the node assigned as the message server resource for that part of the network. The PMS operates as a multi-connect network mailbox, as well as providing emergency real-time transfer and store functions for emergency traffic operations (see the administrative command ALERT).

Once in the PMS system, the command structure is a subset of the W0RLI command set. The PMS is not a full service mailbox/BBS system.

The MESSAGE @ NODE command connects you to a packet message system at the network node indicated. This allows the network to support multiple PMSs at once on the network.

WEATHER connects you to the PMS that is designated as the weather server for the network. The network automatically routes and connects you to the weather node. The weather data is provided through the local console port and is stored on disk. You list the weather products by issuing the LW (list weather) or LS (list server) command at the PMS prompt.

STATISTICS @ NODE returns information about accumulated node activity over a 24 hour period. S Y @ NODE accesses the stats from the previous day.

ROUTE reads a node's routing table and outputs a table outlining the node numbers of all node names in the network, the primary via node, number of nodes on the primary path, secondary via node, number of nodes on the secondary path, and node name for the remote node.

The path's length is weighted with a factor when the network link to the listed node is established. Weighting is done to force the network to a higher speed path if one is available and active. The weight factors are preprogrammed into the node's database.

In the alternate via path column, a node number of 000 indicates no secondary path. Alternate routing allows automatic rerouting of packets past equipment failures or path outages, and has proven to be a valuable feature. You do not need to know the routes, since the network keeps primary and alternate routes hidden. You use the same connect sequence independent of which route is chosen by the network.

Administrative Commands

The UNLOCK command enables and disables the protection on the network's administrative commands. The most sensitive administrative commands cannot be issued to a node by the typical user.

TIME@ NODE sets the real time clock at any TexNet node.

INIT @ NODE does a complete reset of the TexNet node.

A key network function is the ALERT -ON/-OFF @ NODE command. The network alert mode lets the network handle emergency traffic via packet radio. You can enable this mode from any node in the network. When an alert-on is issued at a node, that node sends a "broadcast" command to all other nodes in the network, informing them that alert mode is active at that node. When another user connects to the network, he's informed that an alert is in progress with a command like the following:

```
WA5LHS-4 VIRTUAL CONNECTION 03 AT 08:30:20
ON 8/1/88 PLS DISCONNECT UNLESS YOUR TRAF-
FIC IS RELATED TO THE NETWORK ALERT IN
PROGRESS FROM AUSTIN.
```

All network node disconnect timers are disabled. A special mode of PMS is enabled, which provides a real-time message exchange between the multiple users connected to the PMS. Thus, when one user sends to another, all the standard PMS functions are invoked. In addition, after saving the message on disk, PMS checks to see if the addressee is currently connected to the PMS. If so, PMS automatically displays the message at the addressee's terminal.

PMS becomes a real-time message forwarding system amongst its connected users, with the added feature that all messages are archived to the disk. This feature can be extremely useful in emergency communications, since the stations connected to PMS could be physically located anywhere along the network. To re-enable the timers and return the network status to normal, the alert-off command is issued.

POINT ENABLE/DISABLE/STATUS @ NODE allows access to the control points on the NCP. These points can be used to monitor or affect items at the NCP site.

The DELETE NODE command deletes a node from all routing tables throughout the network. This is used in case a route to a node has changed for some reason.

Network Information Messages

There are two areas of node and network operation in which a network condition report or error message can occur. The first level of message reporting is concerned with conditions of the layer two data link—the connections between the two users' TNCs to the network nodes. The second stage is on the layer three network level—between network nodes. Layer three network errors are reported as plain text or as three-digit network information code (NIC). NICs are returned by the node affected or by the next adjacent node attempting connection. Network codes are three digits and are generated by the layer three software.

TexNet Growth

Currently, TexNet networks exist in many states in the United States, and nodes have been shipped around the world. The Oklahoma and Texas networks should be linked together sometime in 1990. TPRS is continuing to work on both TexNet software and hardware development, along with an increasing focus as an organization on general packet education in Texas.

TexNet is not the newest, fastest, or flashiest of technologies, but it is reliable and flexible, and it works amazingly well. For a summer project now in its fourth year, I would say it at least met, if not exceeded, its original design goal.

Greg Jones' specialities are 10 meter packet and CW. He works for Compaq Computer Corp. Greg enjoys mountain climbing and computer hacking. Contact him c/o the Texas Packet Radio Society, P.O. Box 831566, Richardson, TX 75083.

Information

TPRS is interested in spreading its information and research efforts as widely as possible. If you would like more information concerning TPRS or TexNet, please drop a letter to TPRS, PO Box 831566, Richardson, TX 75083.

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Number 36 on your Feedback card

73 Review

by Daniel Kautz WB8EHS

DX HELPER—Version 1.3

DX Software for the Apple MacIntosh.

DX HELPER
Randy Stegemeyer W7HR
PO Box 1590
Port Orchard, WA 98366
(206) 871-1111
Price Class: $25

DX Helper is designed to be a comprehensive DX software package. It contains a great deal of information that is presented to the DX operator in a user-friendly Mac environment. It's primarily intended to be used as a real-time "where is the DX" finder, but includes much more than that.

The program Selection Menu offers you these options: Bearing List, Distance List, MUF/Area map, MUF/Area/GL map, and Code Practice. Below this are RESET and QUIT choices. Also available in the next menu window is an Options Menu containing switches (ON/OFF) for Gray Line, WWV (reminder), and Refresh (map display).

Which Way?

Beam heading and distance charts from your exact latitude and longitude (within one tenth of a degree) may be printed out as a chart using the Image Writer. There are two forms of map displays. These are displayed only on the Mac screen as a Great Circle map, centered on your QTH (Figure 1), or rectangular map form (Figure 2). The DX location is highlighted on either map with a large black dot. The GL (Gray Line) and sun (white circle with cross hair) locations are updated every 10 minutes (user option) on the rectangular map display only.

Code practice is a stand-alone extra to the main program.

You can configure the scroll box to the left of the map to several operation modes: a DXCC countries list, an international prefix list, or an Oblast' list (USSR). The only list that works with the maps is the DXCC list. The other two supply information in the box under the map area but do not place a location marker on the map.

If you select DXCC for the scroll box (start up default) and click on a country or prefix, the location is shown on the world map (either polar or rectangular) and the following information is displayed under the map:

- Latitude, longitude and zone.
- Time difference from GMT.
- Bearing and distance from your QTH.
- Time and date information was requested (GMT).
- Sunrise and sunset (GMT).
- 3rd party traffic status (yes/no).
- Maximum usable frequency to that location.

Good information for the DX hunter!

Another excellent feature is the 24 hour propagation chart (Figure 3) that replaces the rectangular map display when you double click anywhere on the map, or on a country selection. This chart shows you the current time and the MUF (Frequency vs. Time) for the pointer or country location chosen on the DXCC map. The time line runs from midnight to midnight on the X axis. Frequency runs from 0 to 35 MHz on the Y axis. From this you can determine whether conditions are getting better or declining for the part of the world you want to work.

MUF/Area Map Generation

After you click on the menu selection bar for the MUF/Area, the program requests that you enter the upper frequency limit, midpoint frequency, and lower frequency limit, in MHz. In the example (Figure 4), I chose 21.45 MHz (top of 15 meters), 18.0 MHz, and 14.0 MHz (bottom of 20 meters).

The rectangular map is the only display that is used with this function. The program then begins to make 735 calculations for locations spaced evenly over the map display (a grid 35 x 21). This takes about 5 minutes on my computer.

Calculations that fall within the high to mid limits are illustrated as black squares. Calculations that fall between the mid to lower limit are white squares. Any calculations outside the upper and lower limits are not illustrated. Setting the mid limit to the same value as the upper or lower limit can force only black or only white squares to be generated.

There is an option in the menu bar (MUF/Area/GL) for this same display, but it includes the gray line in the map illustration.

The maps or charts shown on the screen cannot be printed. However, the standard Mac system command <control+shift+4> combination will print the entire screen.

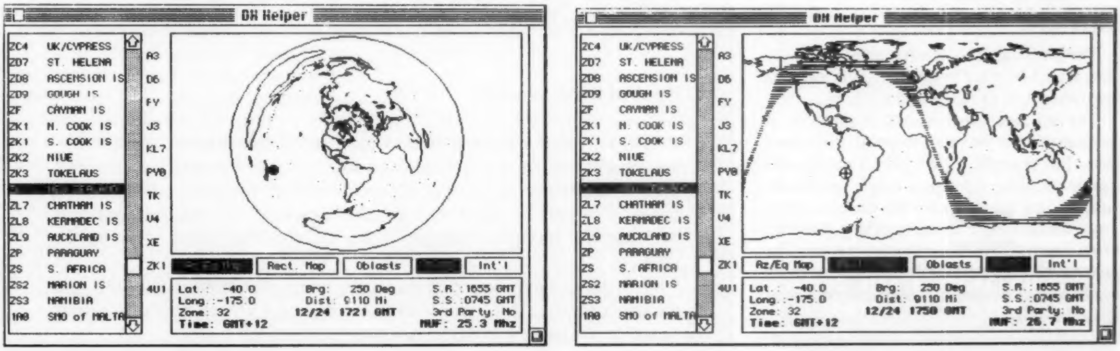
Hone Your CW!

Code practice sends groups of five random characters, with or without punctuation. Speed, pitch, duration (length of time code is sent) and volume are user-selectable. This is a separate program from the DX Helper windows and you must drop out of the main program to use this function.

System Requirements

The program requires a minimum 512K Mac, one 800K double-sided drive, and an optional (required for bearing/ distance printouts only) Image Writer printer. I concur with the manual's statement that anyone with an old 128K Mac should have it upgraded to the new ROM, 512K memory, and 800K drive. My Mac is an original 128K and was upgraded

continued on p. 83



```
ZC4   UK/CYPRESS
ZD7   ST. HELENA
ZD8   ASCENSION IS
ZD9   GOUGH IS
ZF    CAYMAN IS
ZK1   N. COOK IS
ZK1   S. COOK IS
ZK2   NIUE
ZK3   TOKELAUS

ZL7   CHATHAM IS
ZL8   KERMADEC IS
ZL9   AUCKLAND IS
ZP    PARAGUAY
ZS    S. AFRICA
ZS2   MARION IS
ZS3   NAMIBIA
1A0   SMO of MALTA

Lat.:   -40.0        Brg:   250 Deg        S.R.:1655 GMT
Long.:-175.0         Dist: 9110 Mi         S.S.:0745 GMT
Zone: 32          12/24  1721 GMT          3rd Party: No
Time: GMT+12                              MUF: 25.3 Mhz
```

```
ZC4   UK/CYPRESS
ZD7   ST. HELENA
ZD8   ASCENSION IS
ZD9   GOUGH IS
ZF    CAYMAN IS
ZK1   N. COOK IS
ZK1   S. COOK IS
ZK2   NIUE
ZK3   TOKELAUS

ZL7   CHATHAM IS
ZL8   KERMADEC IS
ZL9   AUCKLAND IS
ZP    PARAGUAY
ZS    S. AFRICA
ZS2   MARION IS
ZS3   NAMIBIA
1A0   SMO of MALTA

Lat.:   -40.0        Brg:   250 Deg        S.R.:1655 GMT
Long.:-175.0         Dist: 9110 Mi         S.S.:0745 GMT
Zone: 32          12/24  1750 GMT          3rd Party: No
Time: GMT+12                              MUF: 26.7 Mhz
```

Figures 1, 2. There are two forms of map displays—The Great Circle map, and the rectangular map form.

Amateur Packet Networking

Going beyond just AX.25 . . .

by Brian Lloyd WB6RQN

Amateur packet radio has been growing by leaps and bounds for several years now. The first milestone was the development of the TNC, followed closely by the creation of the BBS. Since that time relatively little changed until the implementation of networking protocols. This article covers some networking concepts, explains where the original popular ham packet protocol, AX.25, falters, and compares and contrasts the more popular networking protocols.

Networking Basics

Most publications attempting to explain network design use the International Standards Organization (ISO) Seven Layer Reference Model. This is why you hear packet gurus talking about the physical layer (layer or level one), the link layer (layer two), the network layer (layer three), and the transport layer (layer four).

Although you may likely envision layers as vertically stacked, like layers of sediment in the earth, the Russian Matriushka doll set analogy is more accurate. The smallest of the set of dolls fits inside the next larger doll, which, in turn, fits inside the next larger doll. Likewise, in the ISO system, the raw packet is first bounded by bit strings that form the protocol for the link layer, which in turn are bounded by bit strings that form the protocol for the network layer, and so on up through the seven layers.

Now, what distinguishes these layers?

ISO Layers

The physical layer is what actually moves data from one place to another. This includes hardware such as radios and modems.

The link layer, such as AX.25 protocol, is responsible for the point-to-point delivery of data. For example, if two packet stations are communicating through a single intermediary, the link layer handles the packet routing from source station to intermediary, and then from intermediary to destination station. The link layer does not look at delivery from source to destination—the transport layer does that job.

The network layer is responsible for routing data through a network to the final destination. For example, say your packet station uses only AX.25, and you want to connect to a station four hops away, with the three intermediaries all being nodes for a given networking system. You first must connect to the first node. Then, from that node, you may issue the connect command for the destination station, or to the next node. Here, the network layer handles your packets from the

Virtual Circuits and Datagrams

Another aspect to consider is whether a given network and transport protocol uses a *virtual circuit* (VC) or a *datagram* type of network. What is the difference between the two, and what are their pros and cons?

In a VC, network packets always follow the same path and always remain in the same order. For this reason, once a VC path has been mapped out, it doesn't need to know about sources and destinations. Only the path identifier (known as a logical channel identifier) is needed to route the packets. A good analogy for the VC approach is the telephone system. In the phone system, you give the address once (by dialing the phone number) and the network establishes the connection. From then on the network routes the signal the same way and does not need to remember the actual source and destination.

In a datagram type of network, every packet must have the source and destination addresses. Every time a packet arrives at a switch or node, the destination address is examined and the switch decides how to route the packet. The analogy for the datagram type of network is the post office. Every packet is like a letter; there is a source and destination address on each one. The letters (packets) are dumped into a mailbox (the network connection) and the post office handles each one separately. If you have too much information to fit into a single letter, you might send it as several letters. Someone on the other must put the arriving letters into the proper order to recreate the original message and request duplicates for any lost letters. This sorting and retransmission request is analogous to the job of the transport layer.

Best of Both Worlds

There's a tradeoff going either way. The VC incurs less "overhead"—routing information attached to each packet—than the datagram method, and so keeps the throughput higher on a healthy circuit, all else being equal. If a part of the circuit breaks, however, VC packets are lost, whereas the datagram system looks for alternate paths to route the packets.

All of the above networking protocols, except KA-Node and ROSE, use the best of both of the above worlds, by running a VC *on top* of a datagram network. KA-Node and ROSE are pure VC systems.

node to which you connected, to the destination.

The transport layer is responsible for the end-to-end delivery of data.

There are three other layers above transport: session, presentation, and application (layers five, six, and seven, respectively). Here, I lump these three together under application, since their discussion goes beyond the scope of this article.

What Layer is AX.25?

Before the advent of networking protocols in amateur packet radio, AX.25 served as both the link and a transport layer (and in fact still does in many stations today). As a link protocol, it ensures delivery of data only between two directly connected stations. There are no intermediate nodes to worry about, so there is no network or transport protocol.

On the other hand, imagine that there are two digipeaters in the path between source and destination. Now we have intermediate nodes (digipeaters) and AX.25 performs end-to-end retransmission on either end. From this point of view, AX.25 is functioning as a transport protocol.

Where AX.25 Falters

AX.25 was never intended to operate as a transport protocol. It doesn't work very well in that capacity—more often than not, communications between two stations fails if there are more than two intervening digipeaters.

Why? The critical point is that, with AX.25 as the transport protocol, any packet lost anywhere between source and destination needs to be *re-sent by the source*.

Assume that the packet delivery probability is 70% between stations (seven out of every 10 packets are delivered without error). This is a common probability. With two stations talking directly to one another this is not a serious problem. With one digipeater in between, the delivery probability drops to 49% (0.7 x 0.7 = 0.49). With two digipeaters in between, there are three hops, and the delivery probability drops to 34% (0.7 x 0.7 x 0.7). Instead of seven out of ten packets being delivered, the ratio has become reversed; only three out of ten packets make it to the destination.

Of course, the originating station retransmits the lost packets, but these must compete with the packets other stations are sending. You see the vicious cycle that occurs here: More and more retries increases the channel loading, which in turn increases the chance of collisions, which leads to further retries. The channel quickly suffers from congestive collapse!

Many avid packeteers soon realized that networking protocols were needed: to use hop-by-hop ACK (acknowledgement of receipt) packets to improve link reliability. (Bear in mind that there is a converse to this—if the delivery probability is very high, it is better to forego the hop-by-hop ACKs in favor of the end-to-end ACKs.)

The network and transport protocols used in amateur packet radio all use AX.25 as a link protocol between points. Some sort of higher level networking protocol is used above/around AX.25 to perform the packet routing function. To date, five networking protocols have risen to regular use in amateur packet radio: KA-Node, ROSE, NET/ROM, TexNet, and TCP/IP. Let's take a look at their strengths and weaknesses.

KA-Node

Kantronics' KA-Node protocol is the simplest of all networking protocols. The user is responsible for manually setting up a network virtual circuit (see sidebar for explanation). To do this, the user connects to the nearest KA-Node and commands that node to connect to the next KA-Node. This process is repeated until the user commands the last KA-Node to connect to the destination. Three intervening KA-Nodes between source and destination require the user to enter four connect commands.

The main advantage of KA-Node is that it uses AX.25 connections between each node to improve the reliability of the end-to-end connection. The other advantage of KA-Node is that it comes as part of all Kantronics TNCs so you don't have to pay extra for it.

> ***". . . it is possible to make Net communicate with all (other popular networking systems) and act as a gateway between these different networks."***

There are two disadvantages to KA-Node: user complexity, and no end-to-end transport layer. It takes a good deal of typing for a user to set up a KA-Node connection to a remote station. Also, if any intervening connection breaks, the whole end-to-end connection is broken, without the source having any knowledge of what actually got through to the other end.

ROSE

The RATS Open System Environment (a ROSE by any other name) is a full implementation of X.25 and TP1—two common commercial protocols—for a TNC. AX.25 is actually a slight modification of something called Link Access Protocol Balanced (LAPB), the link layer protocol from X.25. Some people within RATS decided that it was a good idea to complete the ISO/OSI protocol stack and implement X.25 and TP1 (transport protocol number 1). The result is a ROM for the TNC-2 that turns it into a real virtual circuit packet switch.

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The major advantage of ROSE is that it is available from RATS at little or no cost (the software is available on numerous bulletin boards if you can burn your own ROMs) and it will work with almost any TNC-2 compatible TNC. ROSE also eliminates the KA-Node requirement to send a connect command to each successive node between source and destination. The user connects with the nearest ROSE switch and then tells it to connect to the final destination, using a special country/city code which identifies where the destination can be found. From then on, connection establishment and maintenance is automatic.

ROSE shares the major disadvantage of KA-Node: a disconnect anywhere along the line breaks the entire link to the destination. In spite of this, ROSE is an interesting package that deserves your attention if you have a TNC-2.

NET/ROM

NET/ROM has been around for about two years. The company Software 2000 originally offered it as a plug-in ROM for any TNC-2 compatible TNC.

To use NET/ROM, a user connects to his local NET/ROM, command the local NET/ROM to connect to the NET/ROM nearest the desired destination, then command the remote NET/ROM to connect to the actual destination. All intermediate links use AX.25 to improve reliability.

NET/ROM has some neat features. Every NET/ROM periodically broadcasts all NET/ROM nodes that it knows about. Other NET/ROM nodes hear these broadcasts and forward the information in their own broadcasts. In this way, the information about all the NET/ROM nodes propagates around the network.

NET/ROM works quite well, but it, too, has its limitations. For example, the NET/ROM broadcasts assume that if station A can hear station B's nodes broadcast, then A can route data through B. Unfortunately, this is not always the case, the result being network dead ends.

Another technical problem is that each NET/ROM node must keep a list of all the other NET/ROM nodes in the network. This is fine when the network is relatively small, but it becomes unwieldy when the network gets large. A TNC-2 has only 32K of memory, which is not easily expanded, and the node tables take up precious space.

The last technical problem is that the NET/ROM network layer does not provide for other transport layers besides the standard NET/ROM transport layer. This becomes a problem when you try to do internetwork (connect different kinds of networks).

Finally, NET/ROM is not inexpensive at about $60 per ROM, plus you have to buy NET/ROM all over again to get the upgrades.

Fortunately, there are options that avoid the price. There are other programs that are fully NET/ROM compatible, but are clearly independent of NET/ROM. The first of these is PC/Node, written by John Wiseman G8BPQ.

PC/Node and TCP/IP

PC/Node runs on any IBM-PC compatible computer and provides full NET/ROM capability. PC/Node can make use of TNCs running the KISS (Keep It Super Simple) protocol (most TNCs have this capability), or it can work with an internal packet card, such as the DRSI PC*Packet Adapter or the PacComm PC-100. PC/Node also supports either a W0RLI or a WA7MBL BBS running in the same machine.

The second option is the KA9Q TCP/IP program. KA9Q TCP/IP contains an implementation of the NET/ROM protocol, but it does not include the capability for users to connect with their TNCs. The NET/ROM function of the KA9Q Net program can serve as an intermediary and as a destination node for a NET/ROM network, but not as a termination node for such a network. In other words, Net supports only NET/ROM to NET/ROM packets. Even though it is not a complete implementation, it is quite nice for backbone network nodes where there are no end users.

> ***"The first milestone was the development of the TNC, followed closely by the creation of the BBS."***

TexNet

Unlike the other networking packages described here, TexNet is a complete hardware/software system. A TexNet node includes a Node Control Processor, 9600 baud backbone radios, 1200 baud user access radios, the network software, and a number of application software packages.

TexNet is interesting because, in spite of its simplicity, it works very well. It provides access from user-to-user and user-to-BBS. In addition, many of the TexNet nodes offer weather data and personal messaging.

Technically, TexNet is similar to, but not compatible with, NET/ROM. The Texas Packet Radio Society's choice to offer a complete system keeps the cost down. The TexNet network is a joy to use because it is so fast and reliable.A TexNet node is less expensive than a two-port NET/ROM node, and you get high-speed (9600 bps) backbone trunks in the bargain.

TCP/IP

TCP/IP stands for Transmission Control Protocol/Internet Protocol. Originally developed for the Defense Department TCP/IP is a well-thought-out collection of protocols. TCP/IP was the mainstay networking protocol for government and experimental packet radio long before there was amateur packet radio.

The key to TCP/IP is the Internet Protocol. As the name suggests, IP is designed to interconnect different networks. In the commercial and government world IP is used to interconnect local area networks, dedicated telephone links, public packet switching networks, and packet radio networks. It does this by hiding the differences between the networks.

In amateur packet radio, TCP/IP was written by Phil Karn KA9Q. Phil's "Net" program implements TCP/IP and several associated applications for keyboard QSOs, file transfer, and electronic mail. Net has also been a springboard for others to add functionality to. Net now supports the user information service called Finger, and it supports NET/ROM. Both of these functions were written by others and integrated into the Net package.

One of the problems all the other networking packages have is that they are not compatible with one another. ROSE can't communicate with NET/ROM, NET/ROM can't communicate with TexNet, and TexNet can't communicate with ROSE, etc. On the other hand, it is possible to make Net *communicate with all of them and act as a gateway between these different networks.* Already Net supports TCP/IP over NET/ROM, and there is talk of support for TCP/IP over TexNet and possibly TCP/IP over ROSE. Net is fast becoming the universal packet radio program!

Net is available for IBM-PC compatible computers, the Commodore Amiga, the Atari 520, the Apple Macintosh, and most UNIX™ based computer systems. About the only thing it doesn't run on is the Commodore-64. You can get Net from TAPR for the cost of disk duplication ($1 per disk at last accounting).

Conclusion

Real-live networking is available now. All you have to do is to choose your favorite flavor. All of the networking packages have their advantages and disadvantages. It is my view, however, that the KA9Q Net package stands above the rest because of its universality. It does AX.25 "traditional packet," NET/ROM, and TCP/IP all at once. TexNet is probably the most complete system with everything in one package. NET/ROM and ROSE are interesting because they allow you to turn your existing digipeaters into network nodes with a minimum of fuss. Happy networking!

Brian Lloyd WB6RQN has pursued amateur radio enthusiastically since age eight. He recently co-founded Sirius Systems, a networking business in Petersburg, Virginia. You may reach Brian at: 5712 Stillwell Rd., Rockville MD 20851.

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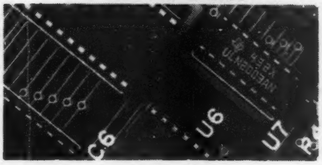

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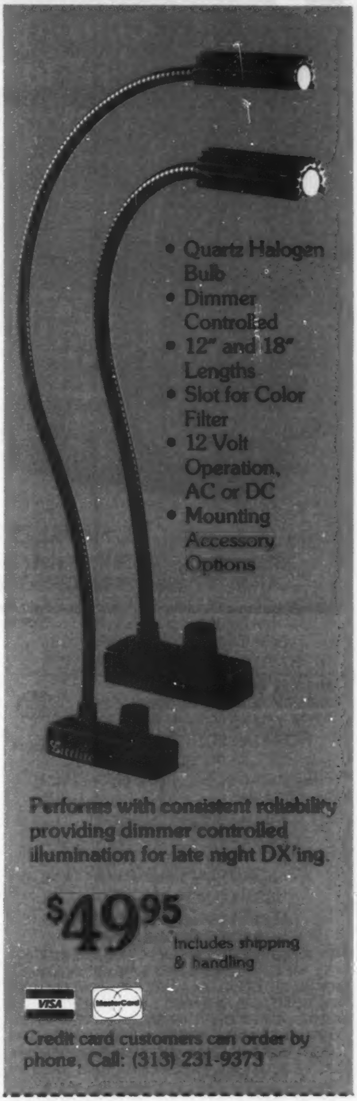

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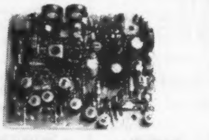

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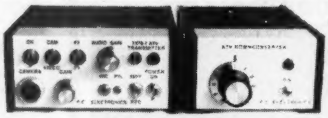

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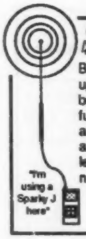
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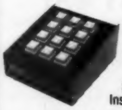

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DXDA '89
The Dynasty Grows. . .

73 Magazine welcomes the new members to the growing DX Dynasty Award cadre! Special thanks to DXDA chairman Bob Reed WB2DIN for processing the results. Congratulations to all for a job well done.

First One Hundred Award Endorsements

12	WD5N	250 Mixed
19	N6CGB	200 All SSB
43	VE6VK	150 Mixed
50	K8MDU	250 All SSB
68	KF5PE	100 All CW
72	IK8GCS	200 300 All SSB
73	WB4I	150 All SSB

New Awards and Endorsements

101	K5AOB	100 All SSB
102	KW2D	100 All CW
103	PY3ARZ	100 All SSB
104	WB4ETD	100 All SSB
105	N2FPB	100 150 All SSB
106	KD3CQ	100 All SSB
107	K4NNK	100 Mixed
108	VU2DNR	100 All 20m SSB
109	AA5BE	100 All SSB
110	PY5OG	100 Mixed
111	VE4ACF	200 All SSB
112	VE4SI	100 Mixed
113	PJ2KI	100 All SSB
114	WB4CKY	100 All SSB
115	W6EOB	100 Mixed
116	KK4IY	100 All SSB
117	IK1YU	100 150 All SSB
118	N8GCN	100 All 20m SSB
119	KB1AF	100 Mixed
120	KB8BHE	150 Mixed
121	KE2CG	100 150 200 250 All SSB
122	VS6CT	100 All SSB
123	G3IZQ/W1	100 150 All SSB
124	WB6FNI	100 All 80m SSB 150 All SSB
125	KA0IAR	100 All SSB
126	K9SM	100 Mixed
127	W6BCQ	100 150 All SSB
128	KA5MSL	100 Mixed
129	WB4FLB	100 All SSB
130	N7GLT	100 All SSB
131	WA0X	100 All SSB
132	KF4GW	100 All SSB
133	N4QGH	100 All 10m SSB
134	VE1CBK	100 All SSB
135	7J1AAL	100 All SSB
136	K6ICS	100 All SSB
137	NZ7W	100 Mixed
138	WB0N	100 All 20m SSB
139	WC7F	100 Mixed
140	F6IFE	100 150 200 All SSB
141	KL7N	100 Mixed
142	KE8LM	200 All SSB
143	WA6YOO	100 All SSB
144	VE2MFD	100 150 Mixed
145	N3APQ	100 All SSB
146	HK1DBO	100 All CW
147	NM3V	100 All CW
148	IK6GFY	100 Mixed
149	WB6UAN/M	100 All 10m SSB
150	NK6Z	100 All SSB
151	KB6IUA	100 150 Mixed
152	W9OKH	100 All SSB
153	WB5FXT	100 150 All SSB
154	NB3E	100 All SSB
155	N2ESP	100 All SSB
156	YV2EJU	100 150 200 All SSB
157	OZ1DXX	100 All CW
158	IK5IIU	100 150 All SSB
159	KA1ION	100 150 All SSB
160	KD3AI	100 All SSB
161	OK1AEH	100 All CW
162	W9LCR	100 All SSB
163	8P6SH	100 ALL SSB
164	KA6SPQ	100 150 All SSB
165	ZF2KH/ZF8	100 All SSB
166	W6MVV	100 150 All SSB
167	JA8CAQ	100 150 All CW
168	KI6WF	100 150 All SSB
169	K2MRB	100 Mixed
170	AA6GM	100 All CW
171	JA0SU	100 150 Mixed
172	NU8Z	100 All SSB
173	G0GRK	100 All SSB
174	YB0VM	100 All 20m SSB
175	DV1BRM	100 Mixed
176	W0TU	100 Mixed
177	N7CNH	100 All SSB
178	PY3IO	100 All SSB
179	YB0ZCA	100 All SSB
180	YB0AF	100 All SSB
181	VE3PQB	100 All CW
182	W2SV	100 150 All SSB
183	N1ADE	100 Mixed
184	WP4AFA	100 150 All 20m SSB
185	KS7V	100 Mixed
186	W2OFB	100 All 20m CW
187	G4ASL	100 All CW
188	N5JUW	100 Mixed
189	KA8WAS	100 All SSB
190	5N0WRE	100 150 200 All SSB
191	AA4IP	100 Mixed
192	JR5KDR	100 All SSB
193	KD2WQ	100 150 All SSB
194	KA3NIL	100 Mixed
195	WA8YWK	100 All CW
196	VE1ACK	100 150 All CW
197	HP2XVB	100 All SSB
198	WB5KYK	100 Mixed
199	N5JUJ	100 150 All SSB
200	N4OBJ	100 All SSB
201	9Q5NW	100 150 Mixed
202	KW2D	100 All 20m CW
203	VE1HA	100 All CW
204	HP8BSZ	100 All SSB
205	IK5JJQ	100 All SSB
206	YC3DKN	100 All 15m SSB
207	I3VKW	100 150 200 All SSB
208	K2EWA	100 All SSB
209	KD3CR	100 150 All SSB
210	N9GDG	100 All SSB
211	KF8K	100 Mixed
212	FD1BEG	100 All SSB
213	DU1DZA	100 All 15m SSB
214	N8IMZ	100 150 All SSB
215	KK4YA	100 All SSB
216	LU1JDL	100 All SSB
217	KA9YYZ	100 All SSB
218	KA4TMJ	100 All 10m SSB
219	WA0DDC	100 Mixed
220	YC1CIS	100 All 15m SSB
221	YC3FNL	100 150 All SSB
222	G0FWG	100 150 All SSB
223	KV4B	100 Mixed
224	N5IET	100 All SSB
225	WA9WIG	100 Mixed
226	N3CDA	100 All SSB
227	KE6KT	100 150 All SSB
228	IK7DBB	100 All SSB
229	JY5EC	100 All SSB
230	N1ETT	100 All 10m SSB
231	PY2DBU	100 Mixed
232	I8IYW	100 All SSB
233	N0ISL	100 All 10m SSB
234	KC4BEB	100 All 10m SSB
235	WA7QQI	100 All SSB
236	KA1RJG	100 All 10m SSB
237	OZ9BX	100 150 All CW
238	KB4HBH	100 All SSB
239	KA3RWP	100 All 10m SSB
240	NJ1T	100 150 All 20m CW
241	W4DCG	100 All SSB
242	YC0RX	100 All SSB
243	VE7OJ	100 All 20m SSB
244	AA4W	100 Mixed
245	N9GMM	100 All SSB
246	KB4HBH	100 All SSB
247	KM4HF	100 All SSB
248	CE1YI	250 All SSB
249	KA1FVY	100 All CW
250	N2GVB	100 All 10m SSB
251	N2DAO	100 All 10m SSB
252	WF8E	100 Mixed
253	YB0HZL	150 All SSB
254	N5MBD	100 All SSB
255	N4SNS	100 All SSB
256	KA3TGY	100 All 10m SSB
257	JN3XLY	150 All 15m SSB
258	N4PUV	100 All 10m SSB
259	KA9MRU	150 All SSB
260	KA4OTB	100 All SSB
261	N4JED	100 All SSB
262	AB4KA	100 Mixed
263	WA7OET	100 Mixed
264	KA3RVH	100 All 10m SSB
265	CE7ZK	250 All SSB
266	NI9J	100 Mixed
267	WB9PTN	100 All SSB
268	KB8DAE	200 All 10m SSB
269	W0CL	100 All SSB
270	WB7VUB	100 All 10m SSB
271	JF6TU	100 All 15m CW
272	ZY3IO	100 All SSB
273	KB4VIR	100 All 10m SSB

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AZORES ISLANDS	CU2
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NORFOLK ISLAND	VK9N
NORTH KOREA	P5
NORTH YEMEN	4W
NORTHERN IRELAND	GI
NORWAY	LA
OGASAWARA ISLAND	JD1
OKINO TORI SHIMA (BALDWIN'S REEF)	7J
OMAN	A4
PAKISTAN	AP
PALMYRA ISLAND	KH5
PANAMA	HP
PANTELLERIA ISLAND	1H
PAPUA NEW GUINEA	P2
PARACEL ISLANDS	BY
PARAGUAY	ZP
PERU	OA
PETER 1ST ISLAND	3Y
PHILIPPINES	DU
PHOENIX	T32
PITCAIRN ISLAND	VR6
POLAND	SP
PONZIANE ISLAND	IB0
PORTUGAL	CT
PRINCE EDWARD ISLAND	VE1
PRINCE EDWARD ISLAND	ZS2
PRINCIPE	S9
PRIBILOF	KL7
PROVIDENCIA ISLAND	HK0
PUERTO RICO	KP4
QATAR	A7
RAPA ISLAND	FO8
REPUBLIC OF CISKEI	S8
REUNION ISLAND	FR
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ROCKALL ISLAND	GM
RODRIGUEZ ISLAND	3B9
ROMANIA	YO
RONACDOR CAY	HK0
ROTA ISLAND	KH0
ROTUMA ISLAND	3D2
RUSSIA-SIBERIA	UA9–0
RUSSIAN S.F.S.R.	UA
RUSSIAN-URAL MT	UA9–0
RWANDA	9X
RYUKYU ISLAND	JR6
SABA ISLAND	PJ
SABAH	9M6
SABAYA	HZ
SABLE ISLAND	VE1
SAIPAN	KH0
SAKHALIN ISLAND	UA9–0
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SCOTLAND	GM
SENEGAL	6W
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SIERRA LEONE	9L
SINGAPORE	9V
SINT EUSTATIUS	PJ
SINT MAARTEN ISLAND	PJ
SMOM	1A
SOCIETY ISLAND	FO6
SOCOTRA ISLAND	7O9
SOLOMON ISLANDS	H44
SOMALI REPUBLIC	T5
SOUTH AFRICA	ZS
SOUTH GEORGIA ISLAND	VP8
SOUTH ORKNEY ISLAND	VP8
SOUTH SANDWICH ISLAND	VP8
SOUTH SHETLAND ISLAND	VP8
SOUTH YEMEN	7O
SPAIN	EA
SPRATLY ISLAND	1S
SRI LANKA	4S
ST BRANDON ISLAND	3B7
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ST KITTS	V44
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ST MARTIN ISLAND	FS
ST PAUL ISLAND	FT8
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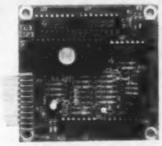

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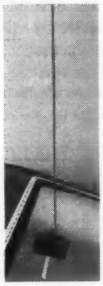

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- *Superior Performance*
- *Radiator Snaps On and Off*
- *Competitively Priced*

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- *Easy to Mount*
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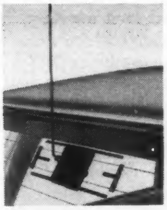
- *Small Size*
- *Competitively Priced*



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TCP/IP for the Macintosh

Now this powerful PC runs one of packet radio's hottest networking systems!

by Doug Thom N6OYU and Dewayne Hendricks WA8DZP

There is a new voice in packet radio known as the TCP/IP. TCP/IP can provide hams with many new features and capabilities never before seen in amateur radio packet communication. Implemented on the Macintosh, these features are easy to use and understand.

TCP/IP Protocols

TCP/IP (Transport Control Protocol/Internet Protocol) is a set of protocols developed in the 70s for use with ARPANET, a network of computers used by the Department of Defense. Today tens of thousands of computer systems in the world use TCP/IP because it allows normally incompatible systems to communicate with each other. Typically, TCP/IP is implemented on large mainframe and mini-computers, and has not been available to the personal computer user. Phil Karn KA9Q was challenged several years ago to implement it on his PC. His co-workers said it couldn't be done.... The result was the KA9Q Internet Protocol Package, now available for several major personal computers. Phil's effort has now made it possible for the average ham who has a computer in his shack to use these protocols for packet.

Why TCP/IP?

Packet radio started out before the personal computer really put its mark on John Q. Public. Early use was purely for keyboard-to-keyboard contacts, later evolving into the PBBS (Packet Bulletin Board System) network that exists today.

TCP/IP provides a basic framework onto which you may add services. An example is Telnet protocol, that provides keyboard-to-keyboard communications, just like traditional packet. Another example is FTP (File Transfer Protocol), that implements a simple file transfer system between stations. SMTP (Simple Mail Transfer Protocol) provides mail services. All of these protocols run at the same time, allowing several people to connect to your station at once. As you can see, each of these are separate, and you can easily add new commands as the system evolves. By using the TCP/IP protocols, we now have the ability to interoperate with these tens of thousands of computers on many of the world's networks, not just on packet.

Net/Mac and BM/Mac

One of the major advantages the Macintosh provides is the consistent user interface. This means we don't have to learn lots of new commands to become proficient with any program. However, this requirement to support an "ease of use" interface has caused some difficulties in our attempt to get Phil's package to run on the Macintosh.

One of the major issues we had to overcome was the conversion of NET and BM (the names given to Phil's programs) into Net/Mac and BM/Mac and make them into modeless programs. In the Macintosh world, all programs are modeless. This means that the user can perform any action at any time, regardless of the current state of the program.

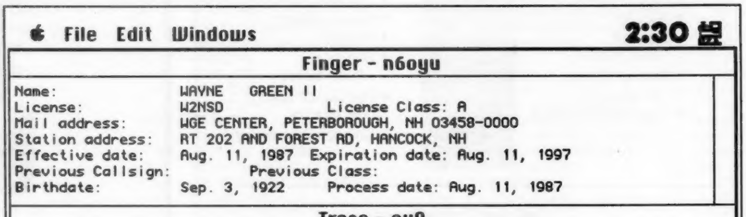
For example, Phil's implementation has a command line orientation. A user enters one command after another to cause the program to perform a given set of actions. In Macintosh programs we can perform additional functions, such as opening desk accessories (calculator, alarm clock, editor, etc.) together with cut-and-paste, between programs at any time.

In bringing KA9Q TCP/IP to the Macintosh, we tried to preserve the command line interface while keeping traditional Macintosh functions. This resulted in a hybrid form: one familiar to the typical Macintosh user, while preserving some of the look and feel of the original version.

What It Does

The Mac offers the major advantage of on-screen, multiple-sessions at the same time. Every time the user creates a new session, such as an FTP, a new window is created for that session where all of the input and output will appear. The session most recently created becomes the active session. The user can switch between sessions by either selecting the desired session from the "Window" menu or by clicking on the session window with the mouse.

The console session window is the only session window active when the program is

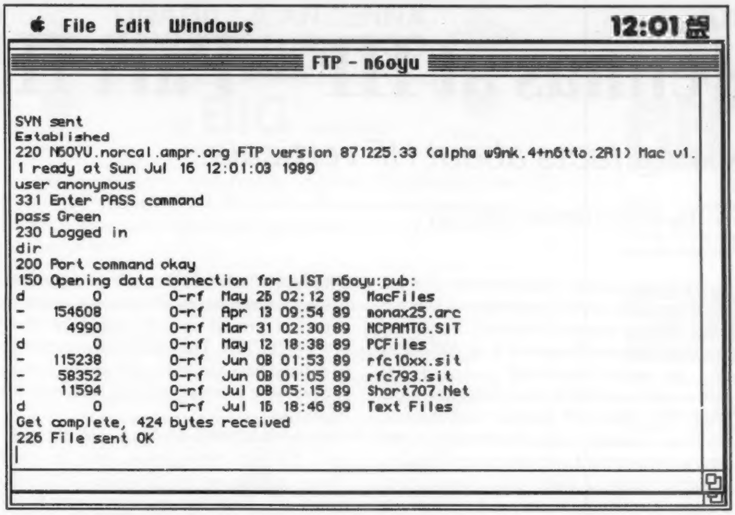


```
Name:               WAYNE   GREEN II
License:            W2NSD            License Class: A
Mail address:       WGE CENTER, PETERBOROUGH, NH 03458-0000
Station address:    RT 202 AND FOREST RD, HANCOCK, NH
Effective date:     Aug. 11, 1987  Expiration date: Aug. 11, 1997
Previous Callsign:          Previous Class:
Birthdate:          Sep. 3, 1922     Process date: Aug. 11, 1987
```

```
AX25: N6OYU->KJ6QA I NR=2 NS=2 pid=Text
0000  License:            WD6GYH             License Class: A.
ax0 recv:
AX25: KJ6QA->N6OYU RR(P) NR=1
ax0 sent:
AX25: N6OYU->KJ6QA RR(F) NR=2
```

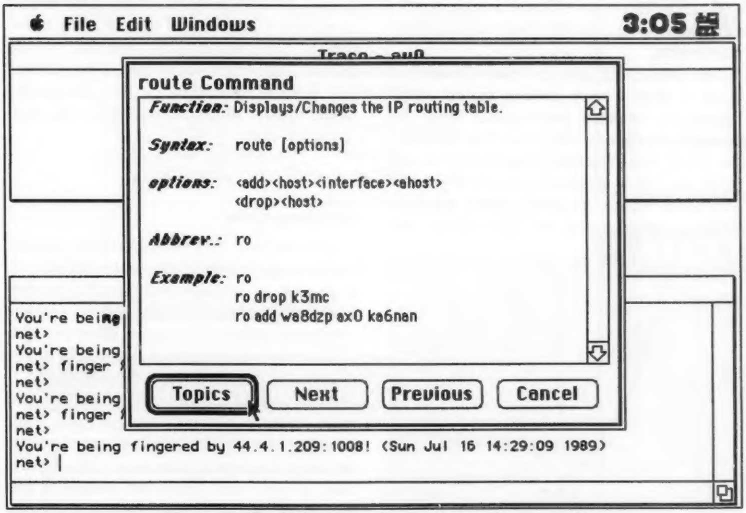
```
net> finger %w2nsd@n6oyu
net>
You're being fingered by 44.4.1.209:1008! (Sun Jul 16 14:29:09 1989)
net>
```

Figure 1. A typical screen with three windows. The top window shows the results of a callsign query, the middle window shows a trace of TNC and computer activity, and the last window is the command console.



```
SYN sent
Established
220 N6OYU.norcal.ampr.org FTP version 871225.33 (alpha w9nk.4+n6tto.2R1) Mac v1.
1 ready at Sun Jul 16 12:01:03 1989
user anonymous
331 Enter PASS command
pass Green
230 Logged in
dir
200 Port command okay
150 Opening data connection for LIST n6oyu:pub:
d        0         0-rf  May 25 02:12 89  MacFiles
-   154608         0-rf  Apr 13 09:54 89  monax25.arc
-     4990         0-rf  Mar 31 02:30 89  NCPAMTG.SIT
d        0         0-rf  May 12 18:38 89  PCFiles
-   115238         0-rf  Jun 08 01:53 89  rfc10xx.sit
-    58352         0-rf  Jun 08 01:05 89  rfc793.sit
-    11594         0-rf  Jul 08 05:15 89  Short707.Net
d        0         0-rf  Jul 16 18:46 89  Text Files
Get complete, 424 bytes received
226 File sent OK
```

Figure 2. An FTP session with a remote host. The user has logged on to the remote system and requested a listing of the files.



```
Function: Displays/Changes the IP routing table.

Syntax:   route [options]

options:  <add><host><interface><ehost>
          <drop><host>

Abbrev.:  ro

Example:  ro
          ro drop k3mc
          ro add wa8dzp ax0 ka6nan
```

```
You're being
net>
You're being
net> finger
net>
You're being
net> finger
net>
You're being fingered by 44.4.1.209:1008! (Sun Jul 16 14:29:09 1989)
net> |
```

Figure 3. The Help screen for the "route" command.

started. Other sessions are created in the normal manner from commands issued from the console session. The user can create a "Log" session which shows the contents of the system log from the time the program was started. The user can scroll the log to see what traffic the program has handled since it was started. You can start a "Trace" session for any active interface. The session window shows the trace output for the interface as specified by the user.

Finger session windows are handled in a special manner. They are allowed to stay open after the session has closed. The user has access to the information displayed in the window until it is no longer required. In addition, the "Finger," "Log," and "Trace" session windows are treated as read-only. No input is allowed to those sessions.

You can resize all session windows and place them on the screen in any way you desire. You can observe the activity on several sessions at the same time. This feature has proven very useful for normal program operation.

Figure 1 shows a typical screen with three windows. The top window shows the results of a callsign query from a callbook server using the finger command. The middle window shows a trace of all activity between the TNC and the computer, and the last window is the command console window. In this example the console is the active window. Just clicking on another window with the mouse makes a window active.

MultiFinder, the pseudo-multitasking program for the Mac OS, runs Net/Mac and BM/Mac at the same time. You can send and receive documents and mail while answering mail. The only requirement, of course, is lots of memory; 2.5 Megabytes suggested! Net/BM and Net/Mac, running simultaneously on a Macintosh 512Ke, uses up too much memo-

continued on p. 73

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Vertical Antennas at HF—Part II

More surprising facts about HF verticals.

by Stan Gibilisco W1GV

In Part I in the September 1989 issue of *73*, the aspects of HF verticals I discuss are polarization, ground wave propagation, grounding, use of radials, and calculating antenna efficiency. In Part II of this tutorial, I discuss tuning coils and traps, useful bandwidth, interference, and low-band DX considerations.

Tuning Coils and Traps

My purpose in discussing these is simply to offer suggestions for minimizing the losses they present. The importance of minimizing losses in coils and traps increases as the antenna is made shorter, since the radiation resistance decreases. A coil with 1.5Ω of loss will not seriously degrade the operation of a vertical antenna 70 degrees high, but will devastate the performance of a vertical just 15 degrees high.

Use the heaviest gauge wire for coil winding. Protect the electrical junctions from the elements and they should not, unless unavoidable, be of dissimilar metals (for example, steel and copper). It's best to either weld or solder them. Minimize the total length of wire in the coil by using the smallest possible coil diameter and/or a low-loss powdered-iron core. Make sure the core is rated for the transmit power you want to put into the powdered-iron core.

What's the difference between a coil and a trap? The major difference is that a coil serves only to physically shorten the length of an antenna without changing its electrical length. A trap also has this effect, but it also allows an antenna to operate on more than one band.

In trap construction, the same general rules apply, with the additional constraint that the capacitors have low loss and be capable of withstanding the voltages that will appear across them. Traps should be resonant at the center of each band for which they are designed, or ideally, for the same frequency that represents the median operating frequency in each band used. For example, if you prefer the lower CW parts of the 40 and 20 meter bands, adjust the antenna and traps for about 7.025 and 14.025 MHz; otherwise set them for 7.150 and 14.175 MHz (the centers of the bands).

Useful Bandwidth

The useful bandwidth of any antenna is defined as that frequency range over which the SWR at the feedpoint is at or below certain limits. In practice, a good limit is 3:1, or else that range over which the transmitter can be tuned for optimum operation without the need for an outboard matching network.

A full-size quarter-wave vertical antenna typically has a useful bandwidth of about 5 percent of the resonant frequency. For example, if the resonant frequency is 14.200 MHz, then the useful bandwidth is around 700 kHz—which extends beyond both ends of the band. This value will *increase* with increasing loss resistance, and will *decrease* as the antenna is shortened and inductively tuned. A properly operating short vertical might have a useful bandwidth of only a few kilohertz when the ground plane (radial system) is sufficient for high efficiency. In other words, you can still have an efficient antenna that is electrically short, but the trade-off is narrow bandwidth.

The interesting (and possibly deceptive) point is that a lossy ground system often appears to enhance performance from the standpoint of bandwidth, as well as lowering the SWR if a matching transformer is not used. See the hypothetical case in Figure 8. The SWR-versus-frequency curves are for a 33-foot vertical tuned for 3.800 MHz. The SWR at 100 kHz of either side of resonance, using no matching transformer and assuming a perfect ground system, would be about 7.4:1 (52Ω/7Ω). The bandwidth as previously defined here would be zero unless a transformer were inserted, and this is assumed in Figure 8a.

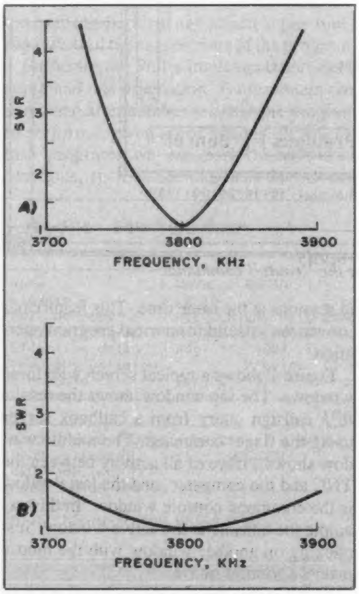

Figure 8. (a) Typical resonant curve for short vertical with inductive tuning, low-loss ground, and matching transformer. At (b) The same antenna without the transformer and with a lossy ground. This graph gives the impression of good performance because of broad-bandedness. Broad-bandedness doesn't always mean high efficiency!

As the loss resistance increases, the minimum SWR becomes lower, and the curve flattens out, giving the impression of broader bandwidth. If the loss resistance were to rise to 45Ω—a quite real possibility with just two or three buried radials—the SWR would be flat at 3.800 MHz, and the curve fairly broad, as in Figure 8b, without the matching transformer. The unfortunate operator would suffer a severely deflated ego if he believed this were a good sign, as the instruments would appear to prove, and then was told, correctly, that:

$$\text{Eff}(\%) = 100(7/52) = 13 \text{ percent}$$

Obtaining Gain

We have seen that you can obtain omnidirectional gain with a half-wave vertical antenna with an extensive ground radial system. The ground plane doesn't increase antenna efficiency (although it may by a few percent, if the ground is very lossy), but it reflects the electromagnetic field, in effect creating a 2-element vertical collinear array. You can add more collinear elements and get more gain; doubling the number of in-phase elements increases the power gain by 3 dB. This is done at VHF and UHF, but seldom at HF because of the practical limitation on antenna height.

Vertical elements may be phased to get gain in some directions at the expense of other directions. Two vertical antennas fed in phase and spaced ½ wavelength apart produce 3 dB gain perpendicular to the line connecting both antenna feedpoints (Figure 9a) and zero signal along that line. If the antennas are fed in opposing phase, such as by adding ½ wavelength of feedline into one of the antennas, this pattern is rotated 90 degrees with maximum signal along the line connecting both antenna feedpoints (Figure 9b).

If both antennas are half-wave in height, and there is an extensive system of radials around each antenna, the gain will be 6 dB over a quarter-wave vertical alone, in the favored directions of the phased vertical system.

Other phasing patterns are possible. One common feed system is to space two verticals ¼ wavelength apart and to feed them in phase quadrature (90 degrees out of phase). The result is a pattern with a null in one direction.

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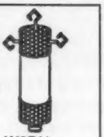

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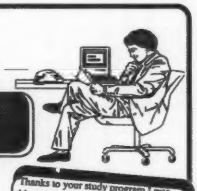

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Tom (W6ORG)
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This is called a cardioid pattern since it is heart-shaped. There is some gain in the favored direction of this system, but the lobe is very broad.

A Steerable Vertical Yagi

Another way to obtain directivity and gain is to use one or more parasitic elements. The driven element may be a quarter-wave vertical antenna, and the parasitic elements about 5 percent longer (for a reflector) or shorter (for a director) than the driven element. A 2-element vertical yagi may use either a director or a reflector in conjunction with the driven element. The parasitic elements are not connected to the feedline, but instead are short-circuited to their radial systems (Figure 10).

You may move the parasitic elements by manually changing the positions of the elements, moving them in and out of pre-set holes or rods in the ground. This does not make for quick switching of the antenna's direction, but it may be useful if you don't need this feature. Alternatively, you may make the parasitic elements 5 percent shorter than the driven element, and lengthen them with small inductances in series, thus converting from director to reflector.

Figure 11 shows a switchable bi-directional system. The parasitic element acts as a reflector when the relay is open, and as a director when the relay is closed and the coil is short-circuited. The parasitic element is physically 5 percent shorter than the driven element; with the coil inserted, it is electrically 5 percent longer. The 2 elements are spaced 0.15 wavelength apart. This distance, *S*, is given by:

$$S_{feet} = 148/f_{MHz}$$
$$S_{meters} = 45.0/f_{MHz}$$

This switchable array gives about 5 dB forward gain over a single quarter-wave vertical. You might put such an antenna to good use on 40 or 80 meters for contest work from the Midwest, for example.

Adding the parasitic element lowers the impedance of the antenna at resonance, which most likely causes an increase in SWR. You may use a matching section or transformer to lower SWR, if desired. You can construct a matching section from a ¼-wave section of 52Ω line (the velocity factor of the line must be taken into account) and the main feedline from 75Ω coaxial cable. Most transmitters will work all right with 75Ω feedlines having reasonably low SWR. If a 75Ω feedline is used, however, do not rely on a 52Ω SWR meter for accurate indication.

The gain and directivity of this antenna will be evident for receiving as well as transmitting.

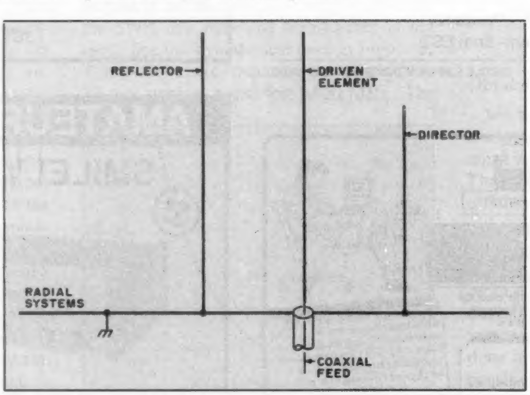

Figure 10. Three-element vertical yagi. The driven element is ¼ wave; the reflector and director are 5 percent longer and shorter, respectively.

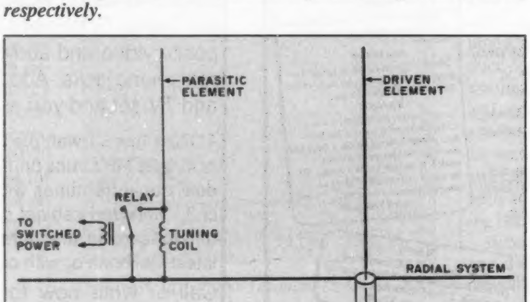

Figure 11. A switchable bi-directional vertical yagi. The parasitic element is physically 5 percent shorter than the driven element, but opening the relay causes the coil to be inserted, lowering the parasitic frequency to that of a reflector.

Verticals and Interference

You often hear that a vertical antenna picks up more manmade interference, especially from appliances such as vacuum cleaners, hair dryers, and electric blankets, than a horizontal antenna. It is true that the vertical component of noise tends to propagate a little further than the horizontal component because the latter is cancelled out by ground plane effects. Nonetheless, you can go a long way to reducing the noise simply by placing the vertical further away from the electrical wires and house. In practice, a vertical antenna may be more likely to pick up interference than a horizontal antenna, simply because the vertical will usually be closer to the sources of interference.

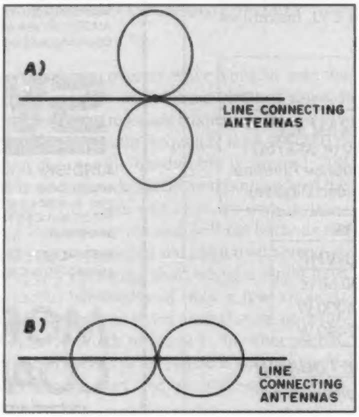

Figure 9. Verticals spaced at ½ wavelength and fed in phase (a) and 180° out of phase (b) produce these directional patterns.

A ground-mounted, backyard vertical antenna is surrounded by houses with their unshielded wiring, and the problem is compounded if utility wires are above ground. In this kind of situation it may be better to mount the antenna up ¼ wavelength and use three or four radials (for each band) that may double as guy wires. Alternatively, you could use a separate receiving antenna, such as a ferrite loopstick with a preamplifier. You can orient this type of antenna to null out the noise.

Vertical antennas may cause more radio-frequency interference (RFI) than horizontal antennas for the same reason; the ground-mounted vertical will usually be closer to home entertainment equipment. Again, the solution is to get the antenna in the clear and well away from home wiring and appliances.

Low-Band DX Considerations

For long-distance communication at frequencies of 7 MHz and below, the vertical antenna is a good choice when space is limited. A dipole antenna must be at least ½ wavelength above the ground to have good low-angle radiation; this will require two supports of that height. But a ¼-wave vertical radiator with a good ground radial system will provide just as much power gain as the dipole, will radiate well at the low angles desirable for DX, and will do it in all directions—with just one support of half the height.

A ½-wavelength vertical without radials will equal the performance of the ¼-wave vertical with radials; adding the radials to the taller antenna will provide 3 dB of power gain at low angles in all directions. Verticals may be phased or combined to form parasitic arrays with directivity and additional gain.

Probably the most visible advantage of a vertical antenna is its unobtrusiveness. Even a quite tall vertical is not an eyesore to most onlookers. You must take care to ensure that the antenna cannot come into contact with utility wires, and some local ordinances forbid manmade structures that will not fall entirely within the owner's property. But for the cost, effort, and space, the vertical antenna may be the best choice for the ham or SWL seriously interested in low-band DX. ■

continued from p. 69

ry to run MultiFinder on that system. We recommend at least a Macintosh Plus.

FTP and MacBinary II Support

FTP (File Transport Protocol) provides a method of reliable transfer of files between machines on a network. You can use it to transfer both ASCII and binary files. To make it easier to transfer files between Macintosh systems running NET/Mac, we added the MacBinary II file transfer protocol to the program. Along with the normal data in a file, this program sends all of the Macintosh specific file information (e.g. program specific icons for the desktop). This is necessary as the Macintosh file system is quite different than that of other systems and requires additional information not transferred in an "image" mode FTP transfer.

Figure 2 shows an FTP session with a remote host. In the example, the user logged on to the remote system and requested a listing of available files.

Online Help

Another useful addition is the online Help Facility to both NET/Mac and BM/mac. To call it up, just select Help from the "Apple" menu. The help system documents all the available commands in each program. Figure 3 is an example of the Help screen for the "route" command.

AppleTalk Support

We added a driver for AppleTalk, the local area networking protocol built in to every Macintosh. Here's an example of how we were able to make use of this support. At my QTH, I have a Macintosh Plus connected to a Yaesu FT-211 via an AEA PK-232. However, I do most of this work on a Macintosh II located across the room. Since AppleTalk is a networking protocol, all I have to do was connect the two computers together with a cable, and voilà!: My Mac II now sends and receives files and mail, with no additional radio or TNC. AppleTalk allows me to assign another IP address to my Mac II, and send/receive files and mail via the Mac Plus. In fact, any number of Macintosh's can be connected (up to the limit of 254!) to a single radio/TNC via the AppleTalk network. With additional hardware, I could even connect to the mainframe computer via a telephone line. No additional software is needed.

Operation With Other Packet Systems

The package also interoperates with regular packet services and telephone networks. It supports normal AX.25 connect mode for keyboard-to-keyboard "chats" and PBBS sessions. A mailbox facility is also available similar to other personal mailbox systems in TNCs. It also handles NET/ROM for chat sessions or as a transport mechanism for sending TCP/IP packets through exisiting modes.

Summary

Bringing the KA9Q Internet package to the Macintosh was very rewarding! We will continue improving the user interface to give the packet community an easy to use, "appliance-like" version of TCP/IP.

The code is public-domain and is available from Doug N6OYU for $5 for the disk, which includes postage and handling. You can also download the code from various locations on the Internet. Doug's Internet address is thomapple.com.

We hope our efforts will stimulate more interest in this intriguing new dimension in packet radio! ■

Doug Thom N6OYU has been at Apple Computer since 1979, and currently serves as a costumer support engineer there. Doug has been active in amateur radio, especially in the digital modes, for four years. Other interests include car racing and scuba diving. He can be reached at 1405 Graywood Drive, San Jose CA 95129-4778.

Dewayne WA8DZP has been licensed since 1961, and is involved solely in packet. He is a free-lance software consultant. Dewayne also enjoys flying his own plane and scuba diving.

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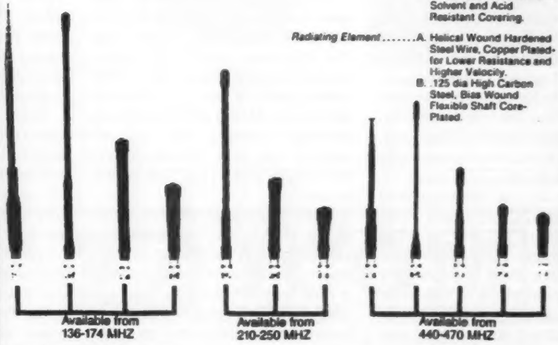
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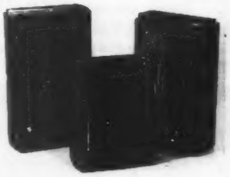

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Continued from page 8

more. Okay, let me repeat a bit of another recent editorial, backed up by the Connections program I saw on PBS. You have to be terribly out of touch not to know that atomic bombs are now portable enough to fit in a suitcase—per the illustration on Connections. So all that's necessary is for one terrorist group to grab enough nuclear material, and guess where they're going to head, suitcase in hand?

Nuclear material comes from atomic power plants, where several recent reports have shown security often is pitiful. Plus we have nuclear sources now in more and more Third World countries. How much trouble would Kaddafi have getting enough for a bomb? The French seem eager to sell atomic energy equipment to virtually any country interested.

So it's more a question of *when* we're going to be faced with a nuclear terrorist than *if*. As I asked in an editorial—how ready is your club? If you're around New York or Washington, you'd better be very ready, with as hardened protection against EMP as possible, with as high-speed automated communications as the state of the art will allow. Depending on Morse Code for communications, where we'll be the only service capable of replacing the telephone, is about as effective as planning to use smoke signals.

Not only are the military almost totally dependent upon telephones, so are virtually all other disaster groups. Civilian Defense officials have almost universally given up even trying to use amateur radio links—too slow, compared to picking up the telephone. Ham communications is slow, seriously prone to errors, and too dependent upon older men without the necessary stamina.

Now, lest I be put down (now, *who* would do that?) for doom and gloom without solutions, the way to resolve this is to first get the FCC to help us find out how to cope with EMP, despite the unreasonable resistance of the DOD. Second, it's time to recognize our need for a million or so active hams, instead of more like the 150,000 we seem to have today. Third, we need to urge the few technically competent hams we have—those who didn't Bash or bribe their way to Extra Class—to start working on high speed automatic digital communications systems—like packet, only much faster. We need to be able to provide million-message throughputs, not dozens, and our gear should be capable of being operated by anyone around who is still alive.

We have the technology to do all this, all we lack is the technicians and the guts to face the biggest challenge of our lives. Lacking this, my suggestion is to move as far away from New York or Washington as you can—and soon! Living near those death traps could be more harmful than smoking, or even Southern California and its coming humdinger earthquake.

The Emperor's Clothes

A few years ago I caused a terrible uproar by proposing that if the code really was as important as was being claimed, then why not have all of us prove every so often that we know the code? Since I knew from surveys that over half of all licensees would fail even the simplest of code tests, I wasn't serious.

Back in 1960, when I started *73 Magazine*, thousands of new hams were coming into the hobby via friends who "gave" them Technician licenses. It was estimated at the time that roughly 75% of all new Techs had no knowledge whatever of the code and only the vaguest interest in theory.

The editor of *CQ* in late 1960 gave Tech licenses to virtually the entire *CQ* staff, none of whom had the slightest technical background or any knowledge of the code. Later he set up a dummy address in Maine and gave them General licenses, still with no tests of any kind. Unfortunately, this activity wasn't unusual for the period.

A few years later, when CB was going strong and more people started getting interested in ham tickets, Dick Bash showed up with a new way around the ham exams. Now, in a weekend of short-term memorization, one could be virtually guaranteed a ticket. Dick would sell you exact copies of the FCC code and written exams and then coach you in how to pass without actually knowing anything. I personally know many Extra Class hams who couldn't pass a General Class code test if their lives depended on it. They Bashed their way to Extra. Some of these are particularly sanctimonious about the code today.

Once the FCC spoiled Bash's game with their VEC tests, the ball was in another court. Now I have no doubt that there are many honest VECs, but I know from my mail and talking with hams at hamfests that there are VECs who view this position more as one of opportunity than of service. The FCC is still trying to sort out how many thousand Extra Class licenses were sold by Puerto Rican VECs. I've recently heard of large scale licenses-for-cash deals in New York, New Jersey, California, Colorado and a few other areas.

Yet, despite what appears to be the widespread buying of ham licenses with no code or written tests, we still have virtually no ham growth—0.8% for the last year.

When you put things in that perspective, it isn't particularly surprising that a high percentage of today's hams would go into complete panic at the slightest suggestion of a re-examination by the FCC. And that's what I ran into when I made the suggestion, even in jest. They had the tar heating up for me in case I attended any hamfests.

When the ARRL proposed to the FCC in 1963 that 90% of the hams be re-examined in order to maintain their voice privileges on the HF bands, the mere proposal of re-examination stopped amateur growth instantly. It so terrorized tens of thousands of hams that they sold their ham stations at fire-sale prices. This, in turn, put 95% of the ham manufacturers and 85% of the dealers out of business within two years.

Incentive Licensing, as the proposal amusingly was called, was a killer. It *was* an incentive of sorts—either you get re-examined by the FCC or you get off the air on voice. That's an incentive, right? Well, it was to the thousands of hams who didn't know the code and believed they'd never be able to learn it.

Sure, a few hams who were given their tickets by friends have taken the time to learn the code and even some theory. One of my *73* editors told me how a friend had forced a ham license on him several years before. Eventually he got interested in repeaters and this encouraged him to start learning theory. He never did learn the code, though he wrote and edited many ham technical books.

So here we are today, arguing about a no-code license, something we've always had. We're talking about offering the no-coders our UHF bands. We manage to forget that Canada has had just such a license available for several years, and so far only about 100 Canadians have bothered to go for it. Sure, let's go the ARRL's proposed route, reinvent an unwanted license, and bet the farm on it.

If you take a look at the Callbook list of licenses you'll find that about 42% are Novice and Technician, and that's no-code. You don't even have to know all of the Morse characters to pass the 5 wpm test, as we showed clearly in a *73* article. Of the 58% with General or higher licenses, what percentage would you say actually passed valid ham exams? By the time we rule out gifts from friends, the Bashers and VEC cash licenses, what have we left? Well, we have the shambles our bands are in today. And we have a widespread lack of technical knowledge. We also have almost completely lost our ability as a group to design or build innovative equipment. I'm having to turn to Japan, Australia, England and Germany to get simple construction project articles for *73*.

Could 20% of today's US amateurs pass a 13 wpm code test? How much would you bet on it? Should we come to grips with this reality and go back to the '50s system where perhaps half of all new hams were fraudulently given their licenses? Should we go back to the last period of ham growth and put Dick Bash back in business selling the word-for-word ham exams and running weekend crash classes? Or should we sell VEC licenses and let them recoup the cost by selling ham exams? The first two systems worked best, the VEC sales haven't managed to provide any significant growth. No, the old license-your-wife, license-your-friends system brought us the most growth. The problem with that system was that it stopped with the Tech license, resulting in almost half the licensees never getting any further, even after 30 years.

What about the golden old days of amateur radio, was it better then? As far as the code was concerned, yes. In the '30s you actually had to be able to copy the code at 13-per to get a ham license. The theory? Well, no. There we had the ARRL License Manual, an almost word-for-word key to the FCC exams. A high percentage of the hams of yesteryear memorized their way to their tickets. Alas, memorization like that lasts for only a few days and is gone—forever. Any college student will verify that for you, in case you've managed to forget that fact of life.

To look at the long term, we've always had a tiny handful of doers and a large contingent of watchers. As a ham publisher over the last 40 years, I've had the privilege of knowing most of the doers personally. When I was a kid on roller skates in Brooklyn in the '30s I visited every active ham I heard on the air. There weren't many hams then, so it wasn't all that difficult. I found that hardly any of them had more than a vague understanding of radio theory, even as simple as it was in those days. I found one ham had built his own receiver, and he was looked upon as a technical wizard by the others.

I did the same as everyone else—I memorized the theory and got my ticket. But it wasn't until I went through the Navy technical schools in 1943 that I actually began to understand the basics of electricity.

I've tried asking some fairly simple technical questions during my talks at ham conventions to see how many in the audience understand them. I'd estimate maybe

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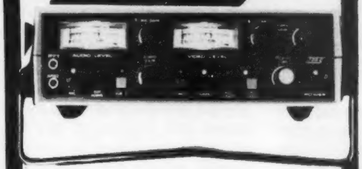

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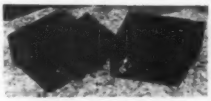

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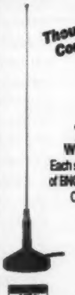

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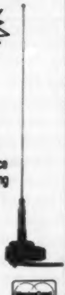

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2% of the hams understand enough theory to get up and try to teach even a Novice class.

When we were handing out ham tickets on street corners, so to speak, we had 11% annual growth and we found that we were attracting youngsters. 80% of the newcomers were youngsters. We also found that for some reason the hamming experience influenced their lives, since 80% of them went on to high-tech careers.

The Bash system, since it cost money, knocked out most of the kids and brought us older hams, but only about 10% as many as we were getting by giving away licenses. The VEC tickets-for-cash put licenses out of the range for most kids, further driving up the average ham age.

Well, what do you think we ought to do next? Shall we go the ARRL route and relive the Canadian fiasco? Shall we go back to the '30s system and make everyone actually pass a code test? The code was more important then, since 90% of all ham activity was on CW. Phone rigs were just too expensive for most hams.

One of the first ham phone transmitters put on the market (around 1939) was the National 600. It sold new for about $25,000 in today's dollarettes. The flood of war surplus drove ham equipment prices down in the late '40s, so I was able to buy a used "600" in 1947 for a fifth of the original price, one of my better ham investments.

Considering the above perspectives, please let me know if you have any proposals which might tend to get amateur radio some growth.

Those Pesky Minorities

Amateur radio in America, for all its facade of internationalism and pretense of being a world fraternity, has been primarily a closed White community. Oh, it's been open to women, but not on an equal basis. And it's never been congenial for Blacks or Hispanics. It's almost getting time to start thinking about what this means to the future of amateur radio, and even to America.

As one of the few hobbies capable of interesting youngsters in high tech careers, amateur radio has a responsibility to our country—to the world, actually. The projections are that by 2000, one-third of our college students will be Black and Hispanic. Are we going to make sure that few of these kids go into technical colleges by continuing to freeze them out of amateur radio? The end result will be even fewer American engineers, technicians and scientists. And that means a guaranteed lower national income as technology blossoms in Asia and Europe, leaving us further and further behind.

I mentioned in a recent editorial how few minorities we have in our hobby. I rarely see a Black at a hamfest. Some of our Puerto Rican hams come to Dayton, but that's about it. How many Hispanic hams do you see at the big Dallas hamfest every year? How many at Miami?

If America was able to keep up with the rest of the world in technology while keeping women and minorities out of amateur radio, we could just excuse what we're doing as another manifestation of good old American red-neckism. We're a bunch of good ol' boys and we're going to keep out the riff-raff.

Women belong in the ham club auxiliary. We need 'em to bring the coffee and doughnuts. They're too dumb to be able to understand a technical talk, right? Well, that's what I see as an almost universal American ham attitude. And, unfortunately, women seem to go along with this without a whimper.

Oh, there are a few belligerent women who attack every imagined slight to women, usually doing more harm than good. Women's Libbers has gotten to be an epithet. Being nasty as a way of breaking stereotypes doesn't help much. What we need are more shining examples.

I know there are some fantastic women in amateur radio. Every now and then I meet one at a hamfest or a club meeting where I'm talking. Some clubs are even proud to have such a woman. But let me ask you this, when's the last time you read an article in a ham magazine about a woman ham who has accomplished anything significant? Come on, fellas, let's put some light in the darkness—let's see some promotion of your good examples. And that holds for women and all of our minorities.

Martin Jue (MFJ) visited us with his chief engineer, Steve. Steve Pau KF5C is an Extra Class ham and comes from Malaysia—Sabah, to be exact. Sabah 9M6 is a beautiful country, one you should make an effort to visit. You aren't going to find a more friendly country. We've had quite an influx of Asians in recent years. You've read about how their children are running circles around American children in school, mainly because their parents have been pushing them to be well educated, while ours have been busy watching Lucy reruns, Johnny and Oprah.

Over half of the American college graduates today are foreign students, and that holds for our technical colleges, too. This wouldn't be so bad if this meant we had to build more colleges, but the problem is that our colleges are failing right and left. Several have failed around my area just in the last year! So we have fewer and fewer colleges and more and more foreign students in the ones we have. It's almost enough to make a person think. Even a ham. Could we be doing something wrong?

A recent letter from an old ham friend was critical of the League for not having any minorities on its board of directors. No Blacks. No Hispanics. And only one woman! Tsk. No, I'm not going to trash the League because they so accurately represent our hobby in this respect—represent the actuality, not the utopia.

Heck, until fairly recently it was impossible for a Jew to get on the board. I remember when the first Jew was elected and was referred to as a Hymie by the other board members. That was only about twenty years ago. Now there are four Jewish directors.

Okay, I've laid out a problem for you. We're doing amateur radio and our country a disservice by excluding minorities. What can we do to change this? Sure, I could tell you what I think, but it's time for you to do some thinking, some problem solving. You tell me. Write to me. Fax me. Send me ARRL messages. What do you propose?

One way to solve a problem is to look for some place in the world where that same problem, or a similar one, has been solved successfully. This has been my approach to coming up with solutions to such miseries as welfare. I looked for a parallel situation where a group of people were desperately poor and needed to start a whole new life. I found a fine example of this in another country, an example which I think could be transplanted to America quite successfully and break the whole welfare system apart. The money we'd save just by solving this mess would largely cure the deficit—at least until Congress could cook up some other ways to spend the saved money.

So—what do you suggest? Do you know of any ham clubs who have welcomed Blacks or Hispanics? I don't remember seeing any pictures of such a club crossing my desk—despite my repeated requests for same. Lacking any communications to the contrary, it's easy to assume that few, if any, ham clubs are even modestly integrated.

With more and more Americans being minorities, we're painting our hobby into a smaller and smaller corner by ruling these groups out as candidates. Tell me again how you don't agree with me 100%—and then tell me why.

Still More Grousing

We're in a technological age, and that means communications, and that means frequencies. Not only are we well into a technological age, it's only going to get more high tech. Just look at the changes in the last few years—telephones so complicated we have to be retrained to use them after every coffee break. Fax in almost every office, spewing out letters and reports all day long. We have to cope with computer bulletin boards, data networks like CompuServe, police radar and cellular radio.

Satellite dishes in back of a million homes. Cable TV bringing in 100 channels of garbage—garbage which the average youngster is watching 5½ hours a day, by the way. The average family is watching 11½ hours a day! Is it any wonder so few know how to read, are able to find the US on a map, or know who won the Civil War? Or that only 7% of high school graduates can even hope to be able to cope with a technical college?

Parents, with the TV on all day, no longer have an opportunity to talk with their kids, so they get almost zero of what we used to call family education. Kids aren't encouraged and helped in their school work by parents, other than Asian immigrant parents. They aren't being taught values, goals, how to cope with growing up, how to cope with drugs such as alcohol, nicotine, pot, uppers, downers and so on.

Is it any wonder in this age of kids left to drift—kids who are being graduated from high school with so little education that many can't read—that something as complex as amateur radio, a technical hobby, seems an impossible goal?

As I see it, we have a choice; we can maintain our high standards . . . and lose amateur radio, or we can try to change the country, to educate parents and get them to turn off their TV sets for a few hours a week. Like any other bad habit, not talking with one's kids comes about as a result. No one means to neglect their kids, but it's just easier right now to watch the Today Show, the evening news, Tonight. So we put off talking with the kids until tomorrow, and tomorrow. This, faster than you think, turns into years and one day you notice you've got a big problem. By then it's too late to establish a rapport, so you're stuck with the mess you've made of your kid's life.

Some parents almost wake up to what's happened when they go to their kid's funeral—drunk driving, or another crack death. Others are more fortunate and only have a teenage pregnancy problem, which quickly converts them to the pro-choice religion. The obvious response is to get mad at the

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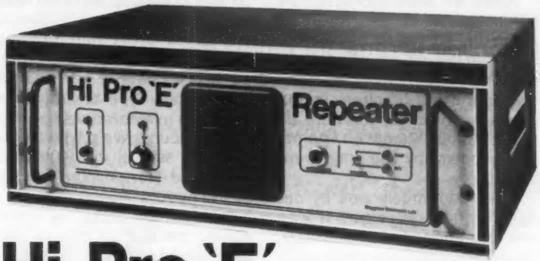

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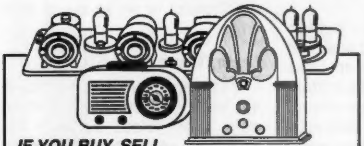

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kids, not ourselves. After all, we meant well. It's just that we were too busy.

Your kids into heavy metal? Probably, unless you've spent some time introducing them to classical music. We're into the largest move into classical music in history, courtesy of the compact disc. Millions of people in their 30s who used to buy rock LPs are now buying classical CDs. Indeed, I've published a guide to classical music which has been immensely popular. That's all fine for getting kids interested in better music, but it still doesn't give parents any more time to talk with their kids. And that means our job of attracting youngsters to amateur radio isn't any easier.

If we're going to have a prayer of holding frequencies, we've got to use them, and that means we need more hams. The reason we haven't used 220 is that we haven't really needed it for anything. 2m has more than enough room in 99% of the country—room to spare—and if we didn't have a tacit agreement that every ham has a right to his own repeater channel, we'd have no problem even in Southern California. 95% of the repeaters there are unused 95% of the time—just like everywhere else. A small group of repeaters handle most of the action.

450 in So. Cal is "full"—why? Private, protected frequencies for every repeater link, repeater and remote base, that's why. The actual use is pitiful. Virtually every link on 450 could be moved to 10 GHz and all put on one freq with directional dish antennas, and with no interference. Instead we have repeater wars and mounting legal battles over who has the right to coordinate these almost totally wasted channels. Quick, graduate more lawyers.

We have 500 MHz going 100% to waste on 10 GHz. Some 99.96% of our total frequency allocations are totally unused. If you were an FCC commissioner, what would be your reaction to this? Here we have what is obviously a dying hobby, something used 99.99% to entertain a dwindling group of crotchety old men who are using about 0.04% of a desperately needed national resource.

We've got high definition TV, improved mobile and personal communications—probably via satellites in the wings—as fast as the Japanese can perfect the new systems for us.

Yes, there was a time when the hobby was needed as a resource for the country. It was a way to get youngsters interested in electronics so they would self-educate themselves and thus be of value in case of war. Today few hams go beyond memorizing the expected questions and writing down the answers. The rest just pay off a VEC and walk away clean. The military would have to start from zero to train 99% of today's young hams—either of them.

When we went into WWII we had about 50,000 licensed amateurs. 80% of those, 40,000, went into the military and were of enormous value. I joined the Navy and found my teachers in the Navy electronics schools were, almost without exception, hams. The schools, by the way, were superb.

WWII was largely won by our development of radar. It was certainly shortened enormously. I know because I was there using it. I was able to guide my submarine, *The USS Drum, SS-228,* right through the middle of Japanese troop convoys on the surface in the middle of the night, keeping track of every troop ship for aiming our torpedoes and every escort for avoidance. They hadn't a clue just where we were as we sunk ships right and left.

One could make a very good case that our amateurs contributed most significantly to the winning of that war.

That's in the past. I doubt if one ham youngster in a hundred (if there are a hundred) would be of much value to today's military. Amateur radio is so far behind both military and commercial communications and electronics that hams today would have to start from zero. We're still sending messages by hand key at around 10 wpm while the world is zipping along at 56K—and speeding up.

The tech age is here—commercially. We hams are still radio relaying with hand keys, sending hey, how are you messages by the hundreds. I got a nice birthday message via the Relay League traffic network, sent two days before my birthday and delivered ten days after; came from Connecticut. Great message handling system for 1989, eh?

In the meanwhile the Japanese are working on voice compression systems which digitally compress the voice down to an effective five hertz bandwidth. The RIAA fuss over DAT tape may have reached your consciousness. A DAT tape will hold two hours of extraordinary hi-fi digital sound. If we digitize the phonemes, we can store 18 months of voice on the same tape. Do we have the potential for setting up voice channels every 10 Hz on 20m—that's 100 per kHz—35,000 channels? We have about 150,000 active hams, so that's about five per channel. We can live with crowding like that.

Is it time yet to speed up our packet system from the present casual 1.2K to 56K? This is pretty standard for commercial work—that's about three thousand words per second. If you can read 300 words per minute, you'd be able to keep up with your reading ability by sending 1/10 second messages every minute. This would allow up to 600 QSOs on every channel. Of course, we can only type at around 30 words per minute, so we'd be badly input bound. We'd type for ten minutes, send it in 1/10th second—read it for a minute—and so on. Ho hum.

Perhaps, like SSTV, we'll start putting our stuff on disk or tape and sending previously written (archive) material. That'll make us work more like a newspaper, spending most of our time writing things to send. I ran into this problem with RTTY back in 1948, forty years ago. We used punched tape then, but we found we had to paste together rolls of it and feed it through the reader to keep up with our printers. 60 words per minute calls for very fast typing, but is slow reading. So I'd keep rolls of tape with punched stuff I'd previously written at hand and feed it into my tape reader while I was punching my answers to the last transmission. When my prepared tapes were sent, I'd rip off my new tape and feed it through. It was hectic, but fun.

Unfortunately, after a couple of contacts with someone to whom I'd sent all my material—now what? It's exasperating to sit there and watch your page while a hunt and peck typist finds each letter on his keyboard and sends it at more like ten words per minute than 60. You sure can get all over your RTTY enthusiasm fast after a few of these turkeys.

The RTTY data burnout problem is very similar to that with SSTV. Watching the same old slides over and over from the chap you've contacted is a killer. Hey, I've already seen your shack, your XYL and the harmonics. Yes, I've seen your dog. Now what? 73, right?

Well, if I ever get the time to get on RTTY, I'm loaded now. I've got around 70 computer disks packed with materials I've written. Heh, heh! With only a little editing, I can take my articles, editorials and letters and have them ready to keep someone reading for a week after a five minute contact. Well, I could if we'd get our speeds up. At 1200 baud I'd be sending for a week. Heck, it's all automatic, so why not? No, I'd never get any second contacts with anyone, but the first would sure be a zinger! I could run through a whole box of paper for them. Get your hard disks ready, I've got about 30 MB ready to dump on you.

Which brings me back to our need to get amateur radio growing—with kids. We need it to keep from losing our hobby. America needs it to keep from losing even more technology to Japan. Our kids need it if they're going to be able to cope with the world of 2000. We're talking technology at every turn—communications, numerical control of machinery, automation and robots, computers on almost every desk in offices and doing the nitty gritty work for most businesses.

If we're going to attract kids we've got to come to grips with the fact that what we're doing now has failed—totally. We're down about 54% in newcomers into amateur radio in the last four years, rapidly heading toward extinction.

Yes, if we could get parents to get their heads out of the family TV set and start giving their kids some help, some encouragement, get them excited about learning instead of being saturated with TV, heavy metal rock and the almost inevitable (now) experimentation with increasingly lethal drugs, so what else is there to do? We might be able to con today's kids into learning the code the way we had to fifty years ago—before TV. Until you figure some way to retrain parents, we either have to change our ideas and come to grips with the real world, or we're out of here.

I do have some hopes of bringing about a major change in our educational system, with an eight-year course in the fundamentals of electronics, one which goes to lengths to get kids interested in hamming. But that's not going to happen next week.

Incentive licensing destroyed the whole infrastructure of school radio clubs which brought us 80% of our hams. The sooner you can get your local schools to work with your ham club to get new radio clubs started, the sooner we'll start at least having a chance at rebuilding our hobby. In the meanwhile, either we find a way to sell the product or we're out of business.

Oops, There Goes Six!

It's beginning to look like a feeding frenzy as commercial interests, their juices up over the ease with which the FCC lopped off 40% of our 220 band for UPS, are going after more ham bands.

There's an announcement in *Broadcasting* magazine (tnx WA4ZID) that Lawrence Tighe K2JIA, who owns WRNJ in Hackettstown, New Jersey, has proposed that the 50–54 MHz ham band be made a new FM broadcast band. Thanks, Larry. ■

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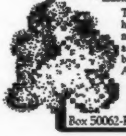

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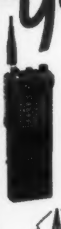

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HF Packet Tuning Aid

Spot-on tuning every time!

by John Reed W6IOJ

The avid HF packeteer eventually develops a sixth sense for correct tuning on these bands. Most newcomers, however, have trouble tuning properly even using a commercial tuning indicator. Such was the case with me and my AEA PK-64 with the HFM-64 bargraph tuning indicator. This isn't surprising, as the setting is critical; for HF packet you have to tune to within 10–20 Hz of the center frequency.

Use Your Ears

An off-frequency station on an HF packet channel sounds distinctly different from properly-tuned stations. With this in mind, I developed a packet signal synthesizer that contains the proper frequency components to use as a tuning aid.

This project began with this general idea, and the resulting device is very effective. Tuning is a snap, and you can optimize it within the needed Hertz. The circuit is simple, and you can buy every part, even the pre-drilled/solder-ring circuit board, at Radio Shack.

How It Works

Refer to the block diagram in Figure 1. A square-wave timer provides the space tone (typically 2,310 Hz), and a diode switch makes the necessary 200 Hz frequency shift keying for the mark tone. A second square-wave timer keys the switch at 35 Hz to simulate packet keying. This is followed by an active filter with a response centered between the space and mark frequencies. The filtered output combines with the radio output for the audible comparison. The assembly includes controls to adjust the radio output amplitude and the level of the synthesized packet signal to the phones or speaker.

For CW applications, the 35 Hz tone switches off to leave only the space frequency, which is also the PK-64 Morse filter frequency. Zero-beating the radio CW signal to the filter frequency gives you much improved automatic Morse decoding.

Circuit Details

See the schematic in Figure 2. One section of a 556 IC dual timer makes the space/mark square wave. C1, R1, and R2 make up the related space frequency time constant, with R2, the 10kΩ potentiometer, providing frequency trim. R1 is the value used to get 2,310 Hz, the HFM-64 space frequency. You can change this resistor for other space frequencies. For example, add 10k for 1,800 Hz.

Switching in C2 makes the lower mark frequency, the series 50kΩ R3 potentiometer changing the reactance enough for the fine trim. The C2 value is for the HFM-64 2110 Hz mark tone. Change C2 for other mark frequencies. For example, add another 470 pF capacitor for 1,600 Hz (assuming 1,800 Hz space tone). Two 1N914 diodes switch C2. Biased off for the space tone, they are switched on for the mark tone by switching transistor Q1.

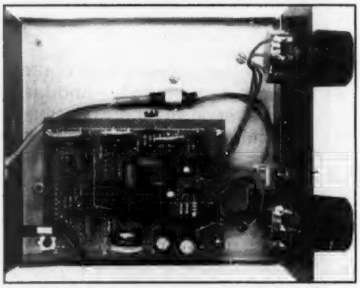
Photo A. Component layout on the HF packet tuning aid board.

The 556 IC second section makes the square wave used to switch between the space and mark tones, the 1-MΩ time constant potentiometer R4 providing a range of a few cycles to several hundred. Experimentally selected, the 35 Hz keying rate sounded most like the nominal packet signal. The PK-64

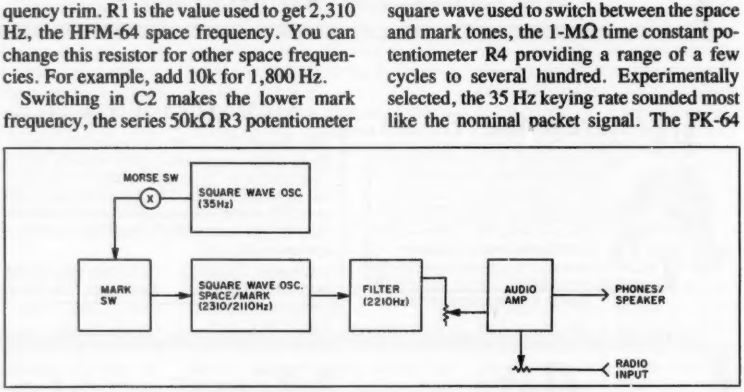
MORSE SW
SQUARE WAVE OSC. (35Hz)
MARK SW
SQUARE WAVE OSC. SPACE/MARK (2310/2110Hz)
FILTER (2210Hz)
AUDIO AMP
PHONES/ SPEAKER
RADIO INPUT

Fig. 1. Block diagram of the HF packet tuning aid.

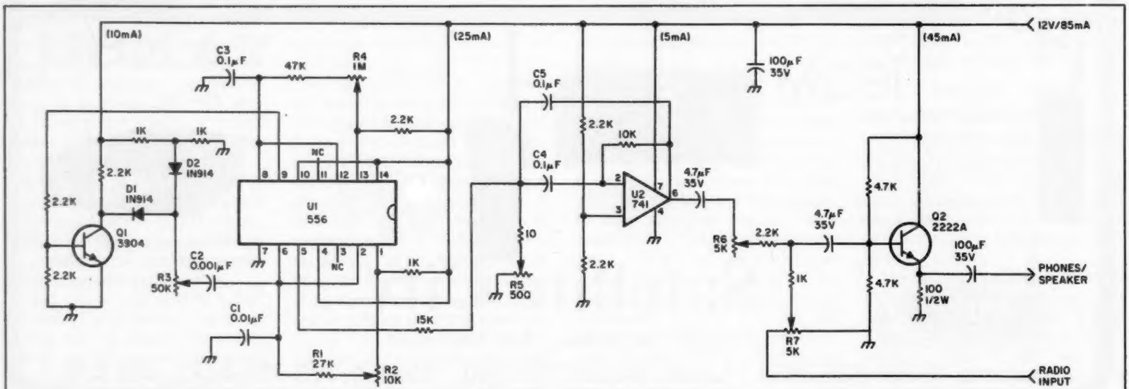
(10mA)
(25mA)
(5mA)
(45mA)
12V/85mA
C3 0.1μF
47K
R4 1M
C5 0.1μF
100μF 35V
2.2K
1K
1K
D2 1N914
2.2K
D1 1N914
NC
8 9 10 11 12 13 14
U1 556
7 6 5 4 3 2 1
NC
Q1 3904
2.2K
2.2K
C2 0.001μF
R3 50K
1K
C1 0.01μF
15K
R1 27K
R2 10K
C4 0.1μF
2.2K
10K
U2 741
2 3 7 6 4
4.7μF 35V
10
R5 500
2.2K
R6 5K
2.2K
4.7μF 35V
4.7K
Q2 2222A
100μF 35V
1K
4.7K
100 1/2W
R7 5K
PHONES/ SPEAKER
RADIO INPUT

Fig. 2. Schematic diagram of the HF packet tuning aid.

Morse function is accomplished with a mechanical switch that disables the modulation, leaving only the space tone.

A typical active op-amp filters the timer square-wave output, and R5 allows you to adjust the peak response frequency. The 500Ω potentiometer is the lowest Radio Shack stock value; a 100Ω value is more appropriate. The filter output and the radio signal combine to drive the output audio amplifier through level control potentiometers and series resistors. This resistive network prevents the tuning aid signals from feeding back into the data controller.

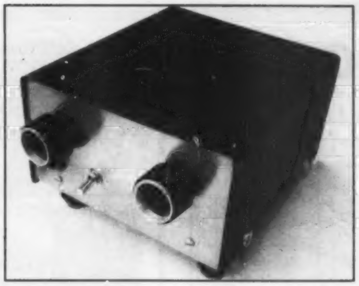
Photo B. Front panel of the tuning aid.

Alignment

For this, you need an accurate space/mark frequency reference. It's ideal to use a signal generator with a frequency counter. You can, however, also get signals from the data controller. The PK-64 has a software calibrate mode by which you can transmit both space and mark frequencies over the mike output lead. A counter permits reading the frequencies directly off the screen. A third, less accurate method, derives the tones from a CW signal on the radio. This assumes your radio has a digital readout accuracy of 50 Hz or better.

Calibrate the space tone by placing the Morse switch in the open position to leave only the single tone, and then connecting the reference tone to the radio input. You then compare the two combined audible tones, using the phones or speaker and adjusting the trim potentiometer R1 to zero-beat the tones. To switch to the mark tone, turn Q1 on temporarily, with a 500Ω resistor connected between the 12 V supply and the open Morse switch (2.2kΩ junction). Mark reference comparison is made by adjusting R3 for zero-beat of the tones.

Op amp frequency adjustment is best made with an oscilloscope. Adjust R5 to equalize the space and mark tone amplitudes. Switching transients should be barely perceptible.

An oscilloscope, however, isn't essential. You can make a fair adjustment by first turning R4 for minimum switching frequency (3–4 Hz), and then adjusting R5 for equal audible space/mark tones.

The switching frequency is not particularly critical. You can increase the frequency by adjusting R4 until the sound is definitely less like that of the nominal packet signal, and then lower the frequency a bit.

Easy To Use

Just tune the HF rig to a packet signal. If, when you turn up the synthesized signal, you get a tone pair similar to the received packet signal, you know you're dead-on! In just a few moments, that long-distance packet text will start scrolling across your monitor... ■

John W6IOJ, a ham since 1933, has contributed to amateur publications since 1941. His career in R&D included radar development at MIT during WWII. John holds 10 patents and has written many construction articles on UHF transmitters. Since his retirement, his hobbies include abstract painting. For more info on his article, please write to John at 770 La Buena Tierra, Santa Barbara CA 93111.

PARTS LIST

C1	0.01 µF, metal film	RS 272-1051
C2	0.001 µF, for 2,110 Hz mark tone, disc ceramic	RS 272-126
	0.001 µF plus 470 pF for 1,600-Hz mark tone	RS 272-125
C3, C4, C5	0.1 µF, metal film	RS 272-1053
D1, D2	1N914	RS 276-1122
Q1	MPS 3904	RS 276-2016
Q2	MPS 2222A	RS 276-2009
R1	10kΩ potentiometer	RS 271-218
R2	27kΩ for 2,310 Hz space tone	
	27kΩ, plus 10kΩ for 1,800-Hz space tone	
R3	50kΩ potentiometer	RS 271-219
R4	1MΩ potentiometer	RS 271-229
R5	500Ω potentiometer	RS 271-226
R6, R7	5kΩ panel potentiometer	RS 271-1740
U1	556 dual timer	RS 276-1728
U2	741 operational amplifier	RS 276-007
PC board	3⅜ x 2⅞ inch	RS 276-168
IC sockets	14- and 8-pin	RS 276-1999 and 276-1995

Fixed resistors are ¼-watt, 5% unless otherwise noted.

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NEW PRODUCTS

Compiled by Linda Reneau

PRODUCT OF THE MONTH

THE WILL-BURT COMPANY/TMD SERIES 700 MASTS

TMD, a division of the employee-owned Will-Burt Company, has a new line of pneumatic telescoping antenna masts especially designed for amateur radio. With this mast, you can quickly retract your antenna for service or esthetic concealment, support on-site emergency communications, and set up for mobile and DXpedition operation. Fast set-up and teardown, and minimum effort.

Pricing begins at $2600 for the TMD 8-30-768, nested height 7'-9", extended height 30', and weight 170 lbs. The Series 700 masts are free-standing, made of heat-treated aluminum alloy tubes (five sections) with stainless steel fasteners, with all exterior surfaces anodized and sealed. Keyed tubes maintain position, and each mast section and non-locking collar has low-friction synthetic bearings. For more specifications and model information, write or call *TMD, PO Box 900, Orrville OH 44667-0900. (216) 682-7015.* Or circle Reader Service No. 201.

CORRECTION: THE CHALLENGER DX-V

In the description of last month's Product of the Month, the Challenger DX-V from G.A.P. Antenna Products, Inc., there is an error. The Challenger, made of aluminum and stainless steel, weighs only **15 pounds**—not 50 pounds. We apologize for this error and any inconvenience it may have caused you.

Please see the September issue for more information on this unique, elevated G.A.P. launch antenna, or contact *G.A.P. Antenna Products, Inc., 6010 Bldg. J, North Old Dixie Hwy., Vero Beach FL 32967. (407) 388-2905.* Or circle Reader Service No. 209.

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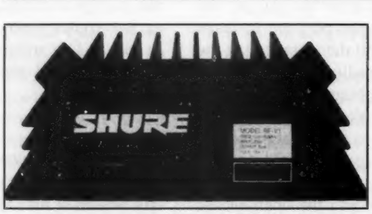
Kenwood's new compact FM transceivers are now available. They run 50 watts, and feature 20 memory channels, DTMF microphone with control functions, remote control head accessory, and a bright amber LCD display. You can control the radio with the 16-key TouchTone, multi-function microphone. On the TM-231A, coverage is extended 2 meter (136–174 MHz receive) for MARS and CAP, with modifiable transmit range. The TM-431A covers 450 MHz (35W) and the TM-531A covers 1200 MHz (10W).

Suggested retail prices: TM-231A, $460; TM-431A, $470; TM-531A, $570. Options include the digital voice recorder and the RC-20 remote controller. *Kenwood USA Corporation, 2201 E. Dominguez Street, Long Beach CA 90810. (213) 639–4200.*



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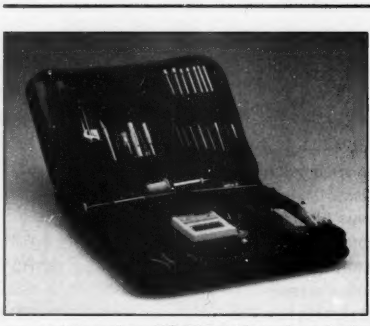
Other SmartAmp features include fused supply voltage leads, a massive aluminum case, heat sink, and rugged construction. SmartAmps come in different frequency ranges and power ratings, FCC Type Accepted. Prices range from $435 to $777. *Shure Brothers Incorporated, Customer Service Department, 222 Hartrey Avenue, Evanston IL 60202-3696. (312) 866–2553.* Or circle Reader Service No. 202.

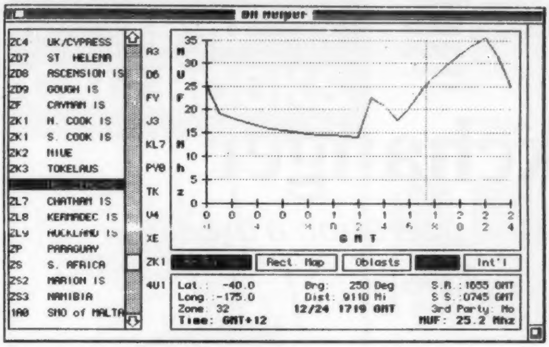


CONTACT EAST

A complete assortment of tools for servicing computer systems, personal computers, terminals, and printers is available from Contact East™. This Computer & Peripherals Service Kit contains a complete assortment of smaller nutdrivers, hexdrivers, and wrenches, RS-232 cable tools, a duplex outlet tester, a key cap puller, IC inserter/extractors, and reversible retaining ring pliers.

Over 40 tools, a small parts storage box, and optional test equipment fit into the black Cordura case. The case also features a document pocket, and two other pockets, with flaps and Velcro fasteners. Model #47-ZCD-B is $275. *Contact East, 335 Willow Street South, PO Box 786, No. Andover MA 01845. (508) 682–2000.* Or circle Reader Service No. 203.

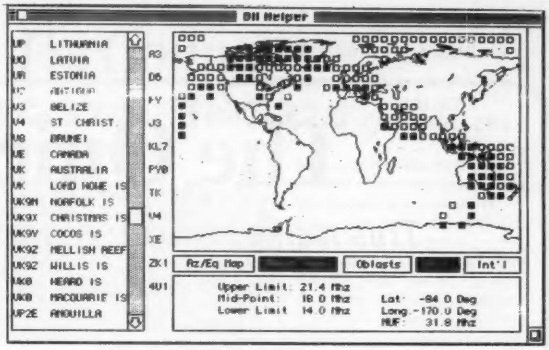
continued from p. 59



```
ZC4   UK/CYPRESS
ZD7   ST  HELENA
ZD8   ASCENSION IS
ZD9   GOUGH IS
ZF    CAYMAN IS
ZK1   N. COOK IS
ZK1   S. COOK IS
ZK2   NIUE
ZK3   TOKELAUS
ZL7   CHATHAM IS
ZL8   KERMADEC IS
ZL9   AUCKLAND IS
ZP    PARAGUAY
ZS    S. AFRICA
ZS2   MARION IS
ZS3   NAMIBIA
1A0   SMO of MALTA
```

```
Lat.:   -40.0         Brg:   250 Deg       S.R.:1655 GMT
Long.:-175.0          Dist: 9110 Mi        S.S.:0745 GMT
Zone:  32             12/24  1719 GMT      3rd Party: No
Time:  GMT+12                              MUF:  25.2 Mhz
```

Figure 3. 24-hour propagation chart. This shows you the current time and the MUF (Frequency vs. Time) for the pointer or country location chosen on the DXCC map. From this you can determine propagation conditions for the part of the world you want to work.



```
UP    LITHUANIA
UQ    LATVIA
UR    ESTONIA
V2    ANTIGUA
V3    BELIZE
V4    ST CHRIST.
V8    BRUNEI
VE    CANADA
VK    AUSTRALIA
VK    LORD HOWE IS
VK9N  NORFOLK IS
VK9X  CHRISTMAS IS
VK9Y  COCOS IS
VK9Z  MELLISH REEF
VK9Z  WILLIS IS
VK0   HEARD IS
VK0   MACQUARIE IS
VP2E  ANGUILLA
```

```
Upper Limit: 21.4 Mhz
Mid-Point:   18.0 Mhz      Lat:  -84.0 Deg
Lower Limit  14.0 Mhz      Long.-170.0 Deg
                           MUF:   31.8 Mhz
```

Figure 4. MUF/Area map. You enter the upper frequency limit, midpoint frequency, and lower frequency limit, in MHz. The program makes 735 calculations for locations spaced evenly over the map display, showing various MUF ranges.

several times to reach this present minimum standard.

The system clock must be set to GMT to get the proper display on the maps. Station latitude and longitude must be entered, as well as the current solar flux (available from WWV at 18 minutes after the hour). These settings are retained in a default file for the next cold startup.

What You Get

The main program is 150,067 bytes (Version 1.3) in size. Also included are four files, DXH1.LIB through DXH4.LIB. The Great Circle map creates file MAPxxxx (MAP4371 in my case). There is also a mini system folder that supplies Finder 5.3. The program is written in a compiled BASIC, which probably accounts for the large size. It also contains a lot of data. Speed, in most cases, is more than adequate for the purpose.

Good Points

The program delivers what it promises. I really like the scroll bar with the guide selections on the right. This helps preselect where to go in the list (see Figure 1). More programs should do this. This program is much handier to use than looking up the information in a magazine or a book. The price is certainly a bargain for what is delivered.

Suggestion

You can't locate a country by name to find out the callsign prefix. You have to scan the prefix list. If you point and click on the map you get the bearing, distance, etc., but not the country or prefix. (Admittedly, this is a major assignment and I do not consider it a fault!)

A Bug

All large programs have faults or, perhaps, "growing pains." I was first issued Version 1.1 to review and found a number of program bugs. I alerted Randy Stegemeyer, however, to my comments on these problems, and he quickly issued me the updated Version 1.3. I am pleased to report that all but one of the program bugs are gone in this latest edition.

The remaining problem occurs when the program first generates the Great Circle map on my QTH. The program "hangs" (stops running) when I use my QTH latitude (43.5) and longitude (71.3), yet it worked fine using any other numbers. My present solution is to use a slightly different number (change by degree) for longitude or latitude, and run again. Randy is looking for a way to correct this problem.

Drawbacks

Any use of desk accessories or playing around with the window resize will screw up the screen display. This is not a problem with the program, but rather with the way that the Mac system uses these features with a BASIC program. The main menu provides a manual RESET reset selection to restore the screen display when this happens.

I haven't been able to try Multi Finder with this program because of the limited size of my computer. Anyone with a Mac SE will be able to check this out.

None of the data is in revisable tables, so if any of it changes the program will become obsolete. This is a problem only if the DXCC country list or the Soviet Oblast' data changes.

Final Impressions

The only truly unpleasant problems I have found are the use of desk accessories with the program and the MUF/Area/GL problem. This seems to be the type of program I would like to have running in the background. However, from the bugs found, I wouldn't buy the program for that purpose until I checked it out with the author. None of the bugs are what I would call serious because no loss of user data is involved, except perhaps for the MUF/Area/GL problem.

Oblast' chasers will find the program very useful.

The code practice works well if you need practice on code groups. Its value to the program should be considered as a nice little extra touch, and not a reason for buying it.

For those of us who don't like to squint at tables in a magazine and like to have the up-to-the-minute DX forecasts using current solar data, this program rates a place in your Mac software library! ■

Number 37 on your Feedback card

HAM HELP

Your Bulletin Board

We are happy to provide Ham Help listings free on a space available basis. To make our job easier and to ensure that your listing is correct, please type or print your request clearly, double spaced, on a full (8½" x 11") sheet of paper. Use upper- and lower-case letters where appropriate. Also, print numbers carefully—a 1, for example, can be misread as the letters l or i, or even the number 7. Thank you for your cooperation.

Would someone please help me? I need a diagram for a Clegg Mark 3 2m transceiver and for a Regency HR-2B 2M transceiver. I will gladly pay for copying expense and postage.

Manuel Varela XE3EA
Calle 13-A #17
Prado Norte
Merida, Yuc. MEXICO

I need schematic or service information on a Regency monitor, Model TML-1, and a Tennelec Memoryscan scanner, Model MS-1. I also need programming information on the Tennelec Memoryscan. I am willing to pay for a copy or can copy and return originals. Thank you.

David Maynard WA3EZN
508 Southfield Drive
Maumee OH 43537

I need the manual and schematic for the EICO Signal Tracer Model 147. I will pay for copy and postage, or will copy and return.

John Woehrle W6KV
151 Monroe Dr.
Palo Alto CA 94306

The Quickchanger

This makes mixed-mode/band operation a breeze.

by Howard E. Cann KA3MRX

When I was bitten by the packet bug, I bought an AEA PK-64 TNC to use with my C-64 computer. Soon I discovered that, in order to switch from HF to VHF, I had to plug and unplug radios, mikes, and wires. A real hassle!

Time and Labor Saver

To solve the problem, I designed and built the Quickchanger, an inteface box that lets you switch a single mike, a TNC, a phone patch, and two speakers, all to either HF, VHF, or off. This is done with the row of six three-position DPDT toggles on its front panel.

Parts for the Box

I bought a 4" x 2" x 5" metal box to hold the Quickchanger, along with six DPDT mini-switches, various mike jacks, and RCA jacks to fit my microphones. See Figures 1 and 2 for the schematic, and the front and back panel control and connector placement. Be sure to use shielded audio cable both inside and outside the unit.

The upper position for all six switches is for VHF, the lower position for HF, and the center position is "off." To go from VHF packet to HF packet, flip the two packet switches to the lower position, then change the parameter on the TNC to HF. To go to voice, switch the two PK switches to the center ("off") position, and flip the mike switch to the either HF or VHF.

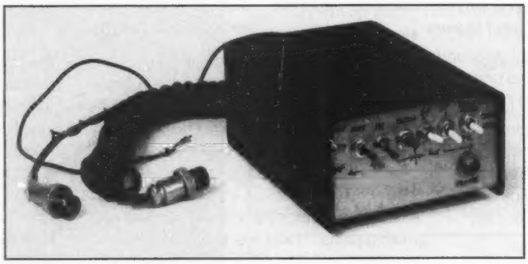
The only problem with the Quickchanger is some distortion in the audio when using the processor in the transceiver. You could easily fix this with filtering capacitors. (I didn't bother modifying mine since I don't use the processor.)

Mode Changing's a Snap!

Now, in an instant, I can switch modes and radios quickly and check for DX easily. In fact, my DX count on packet is headed toward the CC mark with the help of the Quickchanger.

You need only a mike connector to start operating the AEA PK-64, but some TNCs need accessory software, connectors, and an interface. When TNC shopping, don't be wowed by the advertising—read the small print carefully to find hidden costs for extras that are actually required items. With a happy purchase, you'll be off to a good start with the challenges and rewards of packet radio!

Howard Cann KA3MRX has been involved in radiocommunications for 30 years, but finally decided to get his ham ticket when he was a missionary in the Caribbean, because that was a more reliable link than the telephone! He currently works as a building contractor. He is also an emergency communications coordinator for Somerset County in Maryland. His other interest include boating and flying. You can write to him at Route 1, Box 146, Westover MD 21871.



The KA3MRX Quickchanger.

Parts List

- 1 4" x 2" x 5" metal box
- 6 DPDT mini-switches, center "off"
- 3 chassis-mount mike jacks
- 5 RCA chassis jacks and plugs
- 1 headphone jack
- 2 shielded mike cables
- 1 shielded audio cable

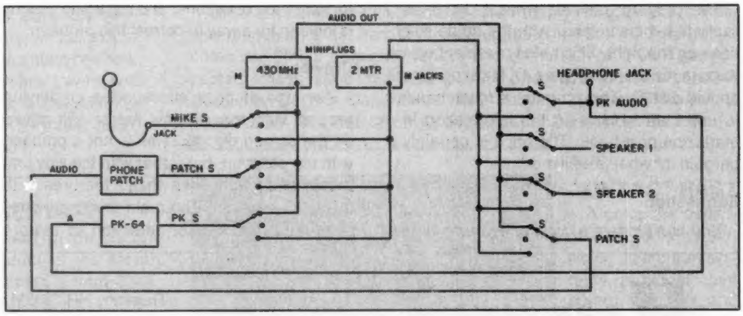

AUDIO OUT
MINIPLUGS
M
430 MHz
2 MTR
M JACKS
HEADPHONE JACK
S
PK AUDIO
MIKE S
JACK
S
SPEAKER 1
AUDIO
PHONE PATCH
PATCH S
S
SPEAKER 2
A
PK-64
PK S
S
PATCH S

Figure 1. Wiring for the Quickchanger. It takes an hour or less to put this together!

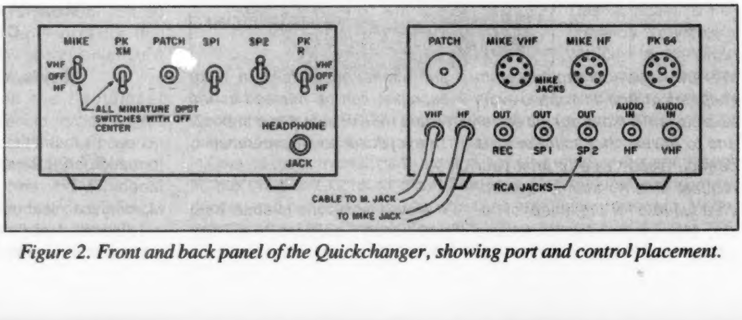
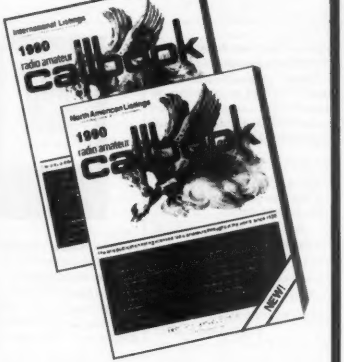

MIKE
PK XM
PATCH
SP1
SP2
PK R
VHF
OFF
HF
VHF
OFF
HF
ALL MINIATURE DPDT SWITCHES WITH OFF CENTER
HEADPHONE
JACK
PATCH
MIKE VHF
MIKE HF
PK 64
MIKE JACKS
VHF
HF
OUT
REC
OUT
SP 1
OUT
SP 2
AUDIO IN
HF
AUDIO IN
VHF
RCA JACKS
CABLE TO M. JACK
TO MIKE JACK

Figure 2. Front and back panel of the Quickchanger, showing port and control placement.

1990 CALLBOOKS



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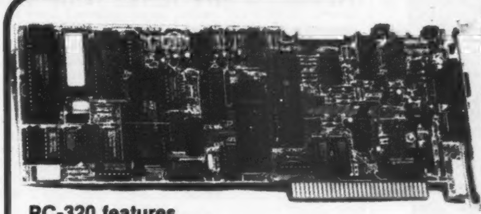

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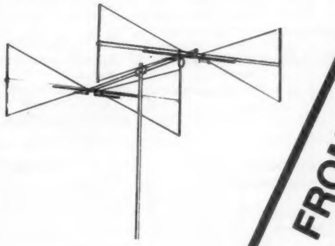

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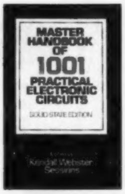

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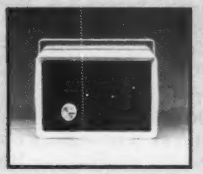

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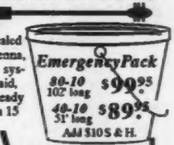

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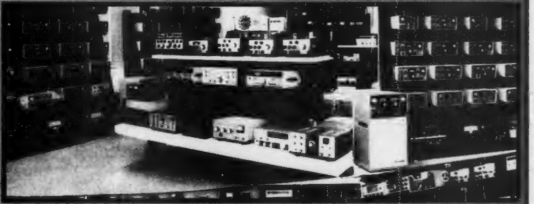

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SPECIAL EVENTS

Ham Doings Around the World

CHICAGO IL
OCT 1

The Chicago ARC will hold its semi-annual Open House between 12 noon and 5 PM local time. Live demonstrations of equipment will be shown by experts. *Dean: (312) 869–HAMS or George, (312) 545–3622.*

ROME GA
OCT 1

The Coosa Valley ARC will sponsor its Hamfest at the Rome Civic Center. Free admission. Camper parking available, but no hookups. Tables $6, outside spaces $3. Amateur exams begin at 8 AM. Reservations requested but walk-ins accepted. *T.J. Freeman NC4G 26 Conn St., SE, Rome GA 30161, (404) 232–2830.*

HAMMOND IN
OCT 1

The Lake County ARC will sponsor its annual Hamfest at the Hammond National Guard Armory. Free parking. Limited tables $5 ea. Admission $3.50. VE testing with novices free and walk-ins welcome. Overnight accommodations close by. Talk-in on the Lake County ARC repeater at 147.00 or 146.52 Simplex. *Ken Brown WD9HYF, 918 Chippewa, Crown Point IN 46307. (219) 663–5035.*

YONKERS NY
OCT 1

Yonkers ARC is holding its Ham Fair at the Yonkers Municipal Parking Garage. Sellers: $8 per space, bring own table. No advance registration. Buyers: $4 admission, under 12 free. Talk-in on 146.865/R or 440.15/R, 146.52. *Y.A.R.C., PO Box 378, Centuck Station, Yonkers NY 10710. Or call John Costa at (914) 963–1021 or (914) 969–6548.*

ROCK HILL SC
OCT 1

The York County ARC will sponsor its Hamfest at Joslyn Park. Talk-in: 146.43/147.03. *York Co. ARS, PO Box 4141 CRS, Rock Hill SC 29731.*

SPRINGFIELD OH
OCT 1

The Independent Radio Assoc. will be holding its seventh annual Hamfest at the Clark County Fairgrounds. All vendor and swap meet activities are indoors. Admission is $3 advance, $4 at door. Under 12 free. Tables $7 advance, $8 at opening. Talk-in on 145.45/R and 224.26/R. *Independent Radio Assoc., PO Box 523, Springfield OH 45501 or call Steve Klipfel KA8QCS at (513) 882–6521.*

BILOXI MS
OCT 7–8

The annual ham/swapfest sponsored by the Mississippi Coast ARA is to be held at the Point Cadet Plaza. Free admission. Talk-in is on 146.13/73. *Edward L. Byrd KA5VFU, 18316 Landon Rd, Gulfport MS 39503. (601) 832–3249.*

WARRINGTON PA
OCT 7–8

Mt. Airy VHF ARC Pack Rats invite all amateurs and friends to the 13th Annual Mid-Atlantic VHF conference at the Warrington Motor Lodge. Also, come to the 18th Annual Hamatama, Sunday at the Bucks County Drive-In Theatre. Advance registration is $5, $6 at the door including conference. Flea market is $5 per person, $7 per carload. Selling spaces $6 each. *Pat Cawthorne WB3DNI, (215) 672–5289.*

HUNTINGTON IN
OCT 8

The Huntington County ARS is sponsoring its annual Hamfest at the PAL Club. Free parking. Handicap accessible. Admission $3.50 advance, $4 at door. 8-ft. tables $5 each. Talk-in on 146.085/.685 and 448.975/443.975. *Jim Covey KC9GX, 1752 Kocher St., Huntington IN 46750*

PORTLAND CT
OCT 10

The Middlesex ARS announces their ARRL/VE FCC license examination session the United Methodist Church. *Ed Kerns KN9Y, (203) 342–3400.*

SYRACUSE NY
OCT 14

The Radio Amateurs of Greater Syracuse will hold their 34th Hamfest at the New York State Fairgrounds. Outdoor flea-market setup $3. Indoor flea-market set-up $7 ($6 if paid before Oct. 7th). Admission $4 before Oct. 1; $5 at the gate, age 16 and under free. Checks payable to "RAGS." Preregister for FCC exams with SASE by Oct. 7th; write *Attn: Exams, "RAGS", Box 88, Liverpool NY 13088.* For more info call *Ed Swiatlowski WA2URK, (315) 487–3417 or Viv Douglas WA2PUU, (315) 469–0590.*

WEST PALM BEACH FL
OCT 14–15

The Palm Beach County Hamfest will be sponsored by the Palm Beach Repeater Assoc. at the West Palm Beach Fairgrounds. Advance admission is $4, $5 at the door. Talk-in (input/output) 147.765/.165. Send SASE to: *From HAMFEST, P.O. Box 461, Lake Worth FL 33460.*

WAUKESHA WI
OCT 15

The Kettle Moraine RAC Inc. will hold its annual Ham/Computer/Video Fest indoors at the Waukesha County Exposition Center from 7 AM–1 PM. New, larger building. Tickets are $2 in advance and $3 at the door. Reserved tables are $3 for each 4′. Reservations accepted until Oct. 11. *KMRA Club, PO Box 411, Waukesha WI 53187.* Include SASE with order.

COLUMBIA MD
OCT 15

The Columbia ARA announces that its 13th annual CARA Ham Fest will be held at the Howard County (Maryland) Fair Grounds. Admission $4 (spouses and children free). Free parking. Indoor tables $20 each for one to four tables, $18 each for five or more. Each table includes one admission. *C.R. Whetstone WA3YOH, 211 Clarendon Ave., Baltimore MD 21208, or call (301) 486–2609.*

LIMA OH
OCT 15

The Northwest Ohio ARC will hold their annual Hamfest at the Allen County Fairgrounds. Camping (electricity $7). All night security. Free parking. Advance admission is $3.50, $4 at the door. Table reservations are $8 full, $4 half table. Send checks 2 weeks in advance. Talk-in frequencies: 146.07/67; 147.63/03; 444.925; 449.925. For table reservations contact *WD8BND, PO Box 211, Lima OH 45802. (419) 647–6513.* Handicap accessible.

QUEENS NY
OCT 14 (Rain Date OCT 22)

The Hall of Science ARC Hamfest will be held at the New York Hall of Science parking lot. Buyers $3, sellers $5 per space. Talk-in 144.300 Simplex link; 223.600/R and 445.225/R. *Steve Greenbaum WB2KDG (evenings) (718) 898–5599 or Phil Kubert N2HYE (212) 777–8648.* For VEC info: *Ann Fanelli WI2G, (718) 847–0155.*

WALL TOWNSHIP NJ
OCT 15

The Shore Area Ham & Computer Fest will be held at the Allaire Expo Center (Allaire Airport), sponsored by the Garden State ARA, Jersey Shore ARS, Neptune ARC and Ocean-Monmouth ARC. Free parking. Admission: Outdoor sellers $8 per 8′ wide space (first come basis). Indoors sellers $20 per table by reservation. Please make check or money order payable to *Shore Area Ham and Computer Fest, PO Box 635, Eatontown NJ 07724.* Buyers $4 advance, (tickets have two drawing stubs), $5 at the door (one stub only). Kids under age 12 and XYLs free. Talk-in: 145.110–600 KC2Q/R; Simplex 146.520. Fly-in frequency: Unicom 123.0. *Al Jackson NK2O, PO Box 635, Eatontown NJ 07724. (201) 922–8121.*

SMITHFIELD NC
OCT 21

Triangle East ARA will hold its 1st Hamfest in the Smithfield Moose Lodge. Admission $4 for adults. Table and 2 chairs $6. Talk-in on 146.88. Send SASE to *Triange East ARA, PO Box 255, Smithfield NC 27577 or phone W2AC (days) at (919) 553–4309; KK4YP (nights) (919) 965–9577 5:30 PM–9:30 PM.*

GRAY TN
OCT 21

The Ninth Annual Tri-Cities Hamfest, sponsored by the Kingsport, Bristol and Johnson City Radio Clubs, will be held at the Appalachian Fair Grounds. A large drive-in indoor and outdoor flea market space is available. RV hookups. Admission $5. *P.O. Box 3682 CRS, Johnson City TN 37602*

BENSALEM PA
OCT 22

The Penn Wireless Assoc. is sponsoring Tradefest '89 at the Yezzi Field. Admission $3 each or $7 per carload. Kids 12 and under free. Spaces $5. Premium or 2x/3x wide spaces available in advance. Talk-in: 146.52/147.00+0.6. *Steve: (215) 752–1202.* For advance tickets send checks with SASE to *PWA Tradefest '89, PO Box L-734, Langhorne PA 19047.*

BROOKLYN PARK MN
OCT 28

Hamfest Minnesota & Computer Expo, sponsored by the Twin Cities FM Club, will be held at Hennepin Technical College. Expanded double-decker flea market, guest speakers, plenty of parking. Talk-in on 146.16/.76. Tickets are $4 advance, $5 at the door. Send SASE to *Hamfest Minnesota & Computer Expo, PO Box 5598, Hopkins MN 55343. (612) 474–1529.*

MARION OH
OCT 29

The Marion ARC will hold its 15th annual Heart of Ohio Hamfest at the Marion County Fairgrounds Coliseum. Large parking area. Advance tickets $3, $4 at door. Tables $6. Check-in on 146.52 Simplex or 147.90/.30 repeater. For information, tickets or tables contact *Ed Margraff KD8OC, 1989 Weiss Ave., Marion OH 43302. (614) 382–2608.*

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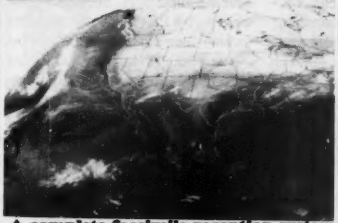

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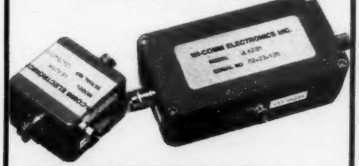

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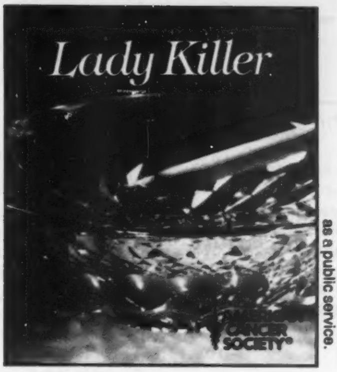

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LETTERS

From the Hamshack

Native American Hams

Over the past couple of years I've read in *73* about your interest in ham radio activity among minorities in the US. Recently, the Little Big Horn Amateur Radio Organization, a ham group for members of the country's original "minority," Native American Indians, has formed. Membership is not limited to Native Americans; hams from other ethnic backgrounds, as well as those who have an interest in Native American culture and history, are also welcome. Currently LBH includes hams from the Cherokee, Crow, Ojibway, Oneida, Sioux, and Tlingit tribes, plus many non-Indian hams. Its goal is to build bridges of understanding and friendship between all Native Americans and other people via amateur radio.

Two code nets are conducted weekly to exchange news and interests. Both convene each Sunday. General class and above operators meet on 14.057 MHz at 2200 hours UTC. The code speed is kept to about 15 wpm. Novices and Technicians meet on 21.150 MHz at 2230 hours UTC. This net is slow code speed for easy copying. Listen for "CQ LBH" followed by a general announcement. Net control stations are WB0L in Minneapolis, MN, and WA2DAC in Peru, NY. WA2DAC is also net manager.

Visitors are welcome and encouraged to check into the nets. For more information about LBH, contact M. McDaniel W6FGE, 940 Temple St., San Diego CA 92106; (619) 222-3912.

Mick McDaniel W6FGE
San Diego CA

How Much?

In today's hi-tech world of wonders and high prices, I can see why the amateur radio ranks are dwindling. How can anyone expect that a no-code license will change the trend? It's the prices that are the problem. If *73* would offer easy-to-construct plans for CW/SSB gear for Novices, you might attract more people.

Carl Forsyth KC4IRP
Charlottesville VA

Carl, try spending more time reading the magazine. Just in '89, we ran a number of fine home-brew articles for QRP rigs (June and February), and many articles on modifying inexpensive and/or older equipment. Get in touch with us to check the article indexes for that specific home-brew project you want to build—we can likely help you!. . . de NS1B

Remember When 30 MPH was Fast?

Code is now like a fine old car. You enjoy it for its beauty, craftsmanship, and esthetic value. It also gets you from point A to point B. The bottom line, however, is that it isn't normally optimal for everyday purposes.

Barry Goldwater's statement ("Looking West," June 1989) regarding the code requirement convinced me. Not everyone needs a fine old car—or even just an older model that runs fine. I like my CW and my trusted, smooth-as-velvet, vintage Navy key, but I wouldn't expect everyone to find one and use it.

Our hobby is evolving—and so must we!

F. Paul Kosbab NF4E
Tulsa OK

Arizona Sunshine

I would like to publicly thank Senator Barry Goldwater for his help. After explaining to Senator Goldwater that the Amateur Radio Society at Arizona State University had no working equipment for 30 dedicated members, he was kind enough to donate a transceiver and receiver to the club. We would all like to express our gratitude to this fine man. Ham radio will have a rewarding future with support like we've gotten from Senator Goldwater.

Matthew Horbund KB7HYF
Tempe AZ

Pure Good Fun

I don't claim to be any better at getting kids interested in amateur radio than any other ham. I never even tried with my three boys. So, looking back, what was it that really got them interested in ham radio? It might have been the time I built them the remote control for their HO gauge trains, or it might have been when I built the transmitter for one of their model rockets, but I seriously doubt it was either. Showing each of them how to punch in WWV and other stations on my Kenwood, and operate my straight key with the sidetone oscillator, really peaked their interest as well.

But what lit up their faces the most was when I let them talk to other hams, just like ourselves, in other parts of the country. I would suggest simply letting youngsters participate, when appropriate. They learn a lot faster when they get to experience it for themselves.

Bill Gardel N3GQW
Downington PA

One of Many Modes

I view CW as just another form of communication, along with phone, packet, and ATV, and I feel it should be treated as such. If as much emphasis were placed on proper and considerate operating procedure and the omission of unnecessary power within the Novice sectors of the HF bands by individuals holding higher class licenses, I thoroughly believe that this would be a greatly improved hobby.

James T. Elliott, Sr. N3FWQ
Baltimore MD

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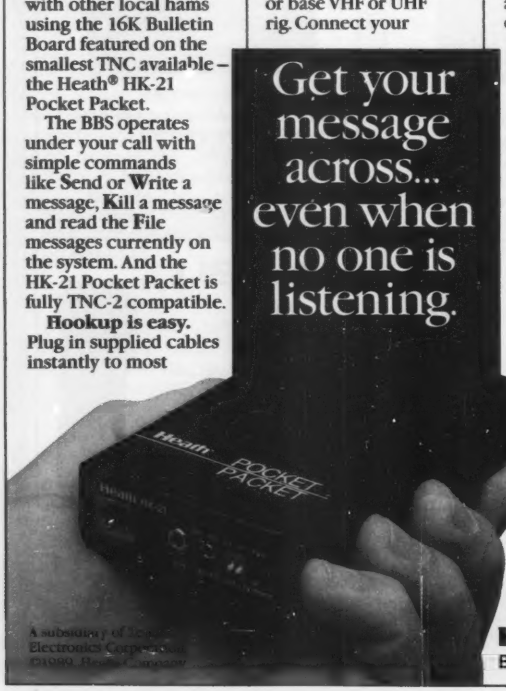

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UPDATES

U, not I

The correct call for Dr. Edward N. Ludin of Cherry Hill NJ is K2UK. His call appeared incorrectly in "Letters" in the November 1988 issue.

C-64 and RS-232

The following corrections and clarifications are needed to the schematics in "RS-232 Port for the C-64," December 1988: the 9V AC that powers the circuit comes from pin 10, not pin 9; the PB0 pin on the edge connector is left floating; the ground on IC 1 (7660 voltage converter) is pin 3; the ground on IC 3 (the 1489) is pin 7; and, on IC 2 (the 1488), pins 4 and 5 are grounded and the output pin, no. 6, is DSR only.

PL Tone Generator

Two alterations are needed to the parts list in "CTCSS, Fast and Cheap," August 1989. Add C4 and C5 coupling capacitors at 47µF each, and change the resistance of the VR1 potentiometer to 25 kΩ.

Challenger

See the correction on last month's Product of the Month, the Challenger DX-V, in this month's New Products department. The challenger weighs 15 pounds, not fifty pounds.

Kaboom Microkeyer

Refer to the schematic in the "Kaboom Microkeyer," pages 28–29, in the September 1989 issue. Change the values of the capacitors that connect pins 3 and 4, and pins 5 and 6 of the 8044 IC, to 0.01 mF. Also, join the non-grounded lead of the 600 PIV diode to the collector leads of the two 2N2222 transistors.

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73 INTERNATIONAL

edited by C.C.C.

Notes from FN42

The torch is passed! Just as the World Olympic Games generates a friendship and bond between countries and athletes, so has the 73 International column between countries and ham radio operators. The editorial "we" are sorry to announce that our International Editor, Richard Phenix, has retired after many years at 73 Magazine. The September 1989 column was his last; 73 Magazine *and the ham community will certainly miss him. 73s to you, Richard, and may you find continued peace at your cabin at Road's End.*

This column will continue to be edited by C.C.C. until a suitable replacement can be found.

For those of you who wish to send photos for the column, we prefer color, but black and white is also acceptable. Address all correspondence for this column to 73 International, WGE Center, Forest Road, Hancock NH 03449 USA.

Roundup

Australia. The Contest Manager of the Australian Ladies' Amateur Radio Association announced the contest rules of their 1989 contest. The contest starts Saturday 11 November 1989 at 0001 UTC and ends Saturday 11 November 1989 at 2359 UTC. Further information can be received from the Contest Manager: Mrs. Marilyn Syme VK3DMS, P.O. Box 91, Irymple, 3498, Vic. Australia.

From Amateur Radio Action (ARA) via Ken Gott VK3AJU: Some different award books are available for those of you who are dyed-in-the-wool award hunters. Contact the following for further information and prices: Amateur Radio Awards (2nd Ed.), Sue Squibb G1TZU, 36 Frognal Gardens, Teynham, Sittingbourne Kent ME9 9HU UK; Amateur Radio Awards (3rd Ed.) RSGB, Lambda House Cranbourne Rd, Potters Bar Hertfordshire EN6 3JE Great Britian; International Awards Guide M.S., Lumban Gaol YB0WR J1 Garuda No. 62 Jakarta 10620 Indonesia; and the K1BV Directory of DX Awards, Ted Melinosky K1BV, 525 Foster Street, South Windsor CT 06074-2936 USA.

Calendar for October

- **1**—National Day, China, Cyprus, Nigeria; Erntedankfest (Thanksgiving), Germany
- **2**—Mahatma Ghandi's Birthday, India
- **3**—National Foundation Day, South Korea
- **4**—Independence Day, Lesotho (12th for Equatorial Guinea, 28th for Czechoslovakia)
- **5**—Republic Day, Portugal (9th for Khmer Republic, Cambodia [Kampuchea], 29th for Turkey)
- **7**—Foundation Day, East Germany
- **8**—Constitution Day, USSR
- **9**—Han-Gul Day, South Koreau; Columbus Day, USA; Thanksgiving Day, Canada
- **10**—Health-Sports Day, Japan; Kruger Day, South Africa; National Day, Fiji
- **12**—Columbus Day, Latin America; Dia de la Raza (National Holiday), Spain (22nd for the Vatican, 26th for Austria, 28th for Greece)
- **14**—Young Peoples Day, Zaire
- **15**—Evacuation Day, Tunisia
- **17**—Mothers Day, Malawi
- **20**—Anniversary, 1944 Revolution, Guatemala
- **21**—Revolution Day, Somalia
- **22**—Labor Day, New Zealand
- **23**—Chulalongkron's Day, Thailand
- **24**—UNITED NATIONS DAY (Dia de las Naciones Unidas) (Jour des Nations-Unies)(Tag der Vereinten Nationen)
- **27**—3Zs Day, Zaire
- **30**—Bank Holiday, Ireland
- **31**—Chiang Kai-shek's Birthday, Taiwan

[*The two "Amateur Radio Awards" books are likely different.—CCC*]

Ireland. An example of ham radio generating friendship and a bond comes from the May 1989 issue of the Irish Radio Transmitters Society Newsletter. Limerick Radio Club and the South Jersey Radio Association recently announced that they have become associated as "Twin Clubs."

The "proclamation" was signed on March 1st by the South Jersey Radio Association and brought over to the Limerick Radio Club by Joe Duffin W2ORA/EI8GT, a member of both clubs.

The purposes of the twinning arrangement is to promote friendship between two Amateur Radio Clubs with a common interest, exchange valuable information regarding the Amateur Radio Service, and encourage the sharing of radio operating experiences from both sides of the Atlantic Ocean.

The arrangement was conceived by Limerick Radio Club during their 40th anniversary celebrations in 1988. The South Jersey Radio Association was pleased to be selected by the Limerick Radio Club for this honor.

While the American Club is over 73 years old, this is the first time in their long history that they have twinned with another Radio Club, and they are very proud of the arrangement. [*This is another wonderful way to develop worldwide friendships. Now is an excellent time for glasnost'. If your club has done something similar, please let us know.—CCC*]

Sweden: (Radio Sweden) GOODBYE SOS—Distress signals sent by ships in the familiar dots and dashes of Morse code are to become a thing of the past, according to the International Maritime Organization (IMO).

From 1993 Morse code will be replaced by the Global Maritime Distress and Safety System (GMDSS), a revolutionary high-tech system which sends a distress signal at the touch of a button.

The system, which will be compulsory in ships worldwide after 1999, has been under development since the 1970s and some of its technology is already in use on British vessels.

It works by sending a radio distress signal which bounces off a satellite to display the ship's position, name, and the time of the incident on a coastguard computer terminal. (Reuter). [*Maybe another good reason for no-code in the future?—CCC*]

U.S.A. A letter from S. Schwartz KE6XS reports that the Chaverim International Net is a group of Jewish amateurs (Jewish hams?) which meets every Sunday at 1300 UTC on 14.326 MHz. Chaverim means friends in Hebrew. The object is to promote fellowship among a worldwide group of call-ins. So far, the Chaverim Net has heard from Belize, Canada, Israel, Ecuador, Peru, and mainly the Eastern part of the USA.

Due to propagation, the So. California section is asking all interested Jewish amateurs west of the Rockies to join another Chaverim net at 1600 UTC on 14.326. Hopefully this will also include calls from many other areas.

AUSTRALIA

Ken Gott VK3AJU
38A Lansdowne Road St. Kilda
Victoria 3183, Australia

What's new (or news) in VK-land? On the awards front, we have a Worked All VK Call Areas award which is far and away the most popular WIA Award. I recently had a batch of 29 applications in one envelope (naturally, a big one) from the USSR, about half from hams and the rest from SWLs, since the award also exists in an SWL form. There is also a VHF version of it. Recently the first VHF WAVKCA award went to Yoshiteru Mori JA2BZY.

Apparently there are lots of J hams, including Yoshiteru, who only needed the VK0. Suddenly the break came—in the form of VK9YQS/VK0 on Macquarie Is., on 6m.

Prior to this, I had a phone call from a 6m specialist alerting me that about 50 J stations would be applying for the VHF WAVKCA. So far, no great rush—only about six applications. But even six is a landmark for this particular award. Maybe the dozens of Japanese stations that made it to VK0 on 6m still need some other call areas—hard ones like VK9. We will see.

On a more personal level, I'm moving the shack. We have a large, solid brick structure designed as a garage, but never

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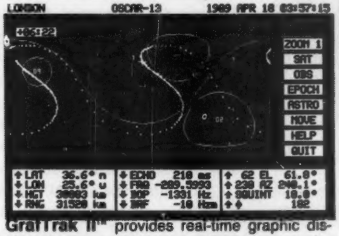

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LONDON            OSCAR-13          1989 APR 18 03:57:15
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↑LAT    36.6° n  ↓ECHO    218 ms   ↑  62 EL  61.8°
↓LON    25.6° w  ↓FRQ -289.5993   ↑ 238 AZ 240.1°
↓HGT  30083 km  ↓DOP   -1331 Hz   ↑SQUINT   18.0°
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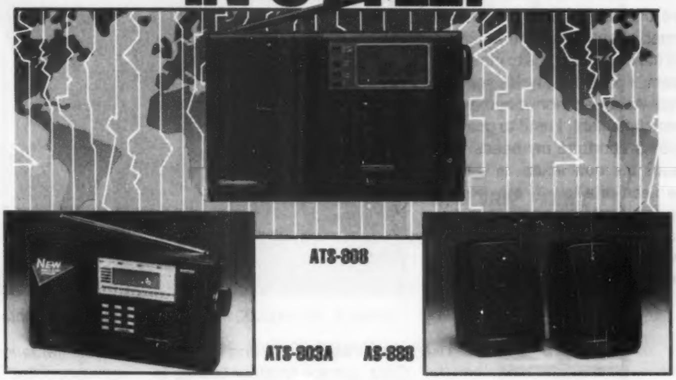

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used as such. I've had power laid on to it and pretty soon will paint the inside, install a ceiling, and generally fix the place up. The biggest job will be getting rid of the old furniture in it.

Then will come a tower. To date I've only had a G5RV. I've confirmed about 160 countries with it, but the time has come to move to a beam. I consider myself semi-retired. As an economic-cum-whatever consultant, I tend to gear my income efforts to my needs. The needs are now acute, in view of the need of a tower, etc. [*Ken is presently attempting to ascertain the life (dead or alive) of over 70 awards "offered" in VK. Quite an undertaking.—CCC*]

HONG KONG

Philip J. Weaver VS6CT
G.P.O. Box 12727
Hong Kong

Phil writes that he contacted the Post Office that administers the licensing in Hong Kong and asked them to approve "The 73 International Universal Permit Application." He sent us a copy of their reply.

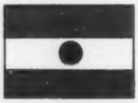
They have no objection to visiting radio amateurs using the international application for a visitor's amateur station licence or licence under reciprocal agreement in Hong Kong. However, the applicant should submit his application in accordance with certain notes on their standard application form, i.e.:

(a) The applicant should submit the application in person, bringing the original copies of the required documents for verification (the originals of the Radio Amateurs' Examination Certificate or pass slip, Passport, Hong Kong ID Card, current amateur licence issued by other administration, etc., should be produced for verification in person to: The Maritime Services Section, Telecommunications Branch, 5th Floor, Sincere Building, 173, Des Voeux Road Central, Hong Kong).

Photo A. JS, VU2JX, making one of the many contacts from VU7JX.

(b) If the applicant is under 21 years of age, the licence will be issued in the name of the parent or guardian, and parent or guardian information will be required. The parent or guardian will be responsible for the observation of the licence terms.

(c) The applicant should sign the declaration provided in para. 6 of the Hong Kong application form. [*The Annual Licence Fee is HK$150. . . CCC*]



INDIA

J. Srinivasan VU2JX
340 5th Main Koramangala
Bangalore, 560 034 India

73 International is pleased to announce that J. Srinivasan (JS) is our new Hambassador in India. JS enclosed an article written on the team that went to the Laccadives in March 1989 (VU7JX) and emphasised RTTY through the BARTG Contest.

DX-PEDITION TO THE LACCADIVES: VU7JX

"HOW ABOUT PUTTING LACCADIVES—VU7—ON THE RTTY MAP FOR THE BARTG CONTEST?" This early morning call from J.S. (VU2JX) to me did unleash a whole chain of the most unexpected events. It was 4 March 1989.

Within the hour, a member of a DXpedition already in the Laccadives was contacted on 40m to check if they would let us operate RTTY for the BARTG contest . . . but no enthusiasm showed up. Before the night was out, Nat (VU2NTA) and Vidi (VU2DVP) swelled the size of the team to a forceful four.

John Troost (TG9VT), the catalyst of this idea, was informed promptly and the whole RTTY clan got to know: the first ever VU7 on digital mode! Special permits to the islands were applied for.

Passage from Bangalore to Cochin, Cochin to Agathi and then to Bangaram and back was booked. It had to be postponed, cancelled and rescheduled several times before our arrival, *en fin*, at Conchin ultimately on the 15 March, with bags and baggages of rigs, antennae, masts, et al.

All domestic and business affairs were rearranged. There was nothing in our collective consciousness except getting to the Islands and getting on the air. Were we surprised to know that no ship was to leave for the Islands before 18 March, the date of commencement of the contest! The twice weekly turbo-prop flights had been cancelled. The heroic aircraft needed maintenance and recertification, having reached the end of its certified life! The availability of a helicopter was annoyingly uncertain, and its capacity to carry the beam, mast and other equipment in doubt!

The formidable Bernie (SWL Bernard Abroa) and vigorous Vidi brought in the whole bunch of aviators to our chambers and saw to it that we got into Agathi not too far behind our antennae.

The multi-hued sunset and the much wearied team landed together on the paradise on earth—the Bangaram Island, in Lakshadweep as the Laccadives is known in India.

Can we ever thank enough the sporty tourists—foreign and Indian—who carried the antennae and mast literally on their willing shoulders throughout their cramped flight? Can we ever forget Capt. Krishnan, our pilot, who strayed into our shack and stayed up well into early morning and lent

Photo B. VU7JX's Shack by the Sea.

Photo C. VU7JX tribander in Paradise.

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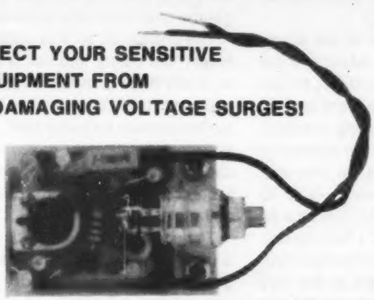

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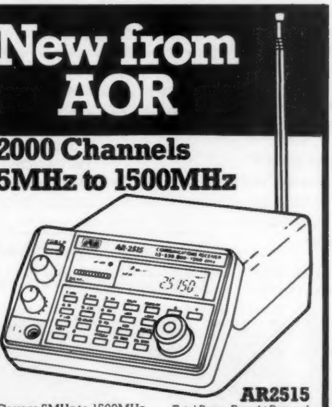

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Say you saw it in 73!

his strength—physical and moral—as we put the antennae up and set out the rigs?

Utterly unmindful of the strong superstition of the Islands of not climbing trees after dusk, an admirably agile angel went up and down the sky-reaching coconut-trees and strung up our dipoles for 40 and 80 metres. In the cool breeze of the early morn—at 2130 hrs UTC (it was 3 AM local time on 17 March)—VU7JX's first call emanated from the palm-thatched, airy cottage, set right on the very lap of the loveliest lagoon. **What a take-off point! What a view!! Window to the world indeed!!!**

Thanks, Arasu. You and your adorable XYL made us feel absolutely at home right away. Unceasing (diesel) power and unlimited hospitality! You and your boys are not employees of the resort, but our expansive hosts.

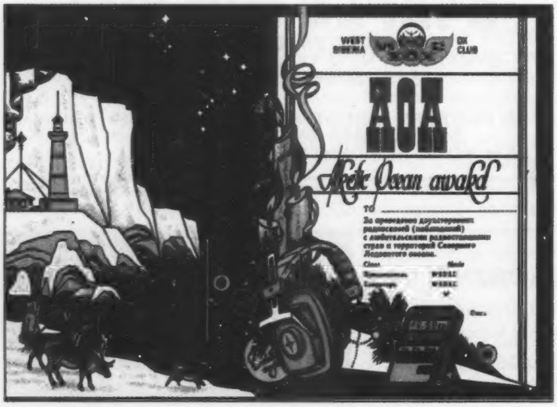


Photo D. AOA Arctic Ocean Award from the West Siberia DX Club, sent by UA9MA. Loosely translated by Bryan NS1B: "For two-way communications (observed) with amateur radio stations of the countries and territories of the Arctic Ocean."

The lights that were switched on in the shack in the evening on 16 March were put out only after the antennae were brought down and everything packed in the wee hours of 24 March.

What a ready and resounding response we found from fellow-hams throughout the dxpedition! Memorable! A deeply satisfying contest of six hundred plus RTTY points and around five thousand CW and Phone QSOs indeed moved us towards forgetting and nobly forgiving the intentional QRM; but can we ever forget those guardian angels ever present with us on every band and politely policing it?

Since our QSLs are already arriving at their various destinations, our only regret is that we did not stay longer and work all of you, out there, beaming towards Bangaram. One h(sw)ell of a pile-up!!!

The unpolluted air was a magic healer; the balmy weather, a tonic. Every meal a veritable repast: succulent tuna, tasty lagoon-fish, tender chicken and juicy beef, every morsel delicately grilled and caringly offered. The heady palm-juice or the chilled beer . . . sheer ambrosia!

The coral Laccadives (meaning a lakh of islands), populated by graceful people and generous coconut palms, surely wear Bangaram (the golden one) as the crown. In shape a doughnut, adorned by lush green and cerulean blue waters, miles to wade in, swim, snorkel, paddle or wind-surf.

Thank you, micromaniacs, who write soft-wares on propagation. Based on your predictions we got onto the contest several hours after the start of the contest; and it did pay rich dividends!

Special thanks to you, John (TG9VT); but for your not so gentle-goading, we would have regrettably let this possible DXpedition pass us by. A51 can not be far for us if you are by our side!

Reels of strong wire-rope, the sturdy antenna-mast and our hearty greetings are left behind with Arasu, the Manager of the Island Resort for you hams, arriving there in the not so distant future.

Must all good things ever come to an end? .... Until then, 73s, Rom VU2RUM Box 4250, Bangalore, India.

[When do we leave, Wayne?? —CCC]

TECH TIPS

Pearls of Tech Wisdom

Secret Bandwidth

As the product literature indicates, when the ICOM IC-761 is in SSB mode, its bandwidths are 2.4 kHz and 2.6 kHz with the filter switch in the "in" and "out" positions, respectively. However, there is a third bandwidth for receiving on this radio. Leave the filter switch in the "out" position and place the IF shift button in the "in" position for IF shift, and the bandwidth becomes 3 to 3.2 kHz wide.

When using just the filter switch to select the advertised wide and narrow positions, you receive and transmit using both the 9 MHz and 455 kHz filter; when using the above method for wider selectivity, you're apparently receiving through the wide ceramic 455 kHz filter only, bypassing the 9 MHz filter. Here's the pertinent data:

9 MHz	455 kHz	Bandwidth
FL-80	CFJ-455K5	2.6 kHz
FL-80	FL-44A	2.4 kHz
By-passed	CFJ-455K5	≈3.0 kHz

Jim Nance KE4WY
Douglasville GA

A Real Turn-On

If your ICOM with an internally switched power supply turns off when you don't want it to, leave it turned off and unplug it for about a minute. Then plug it in and turn it on. Assuming everything else is okay with the rig, the radio should come back on and put you where you left off, because, while the power supply has no fuse, it does have an auto-protection circuit.

Bill Hickox KB5DZ
Houston TX

Super Simple Solution

If you use an IC test clip for troubleshooting, you've probably discovered that the test contacts are so close together it's difficult to attach a probe without touching adjacent contacts, and touching the wrong contact can cause damage in some situations.

If the contacts are long enough, this fault can be corrected by bending some of them. On one side, bend every other contact outward about 45 degrees and bend the remaining contacts inward. On the other side, the contacts opposite those that were bent inward should be bent outward, and those opposite the ones bent outward should be left alone. This also makes it easier to count to find a particular pin. The photo shows how easy it is to attach a probe with the wide spacing that results.

Charles E. Cohn KK4CS
Austell GA

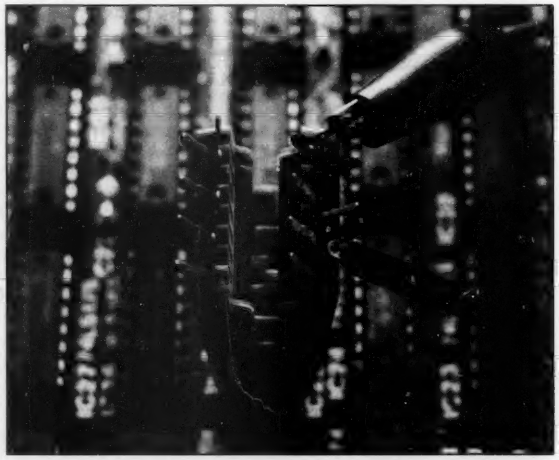
QSK at 30 WPM

High-speed keying is great, but it can create problems. When pounding code into the Kenwood TS-440S at about 30 wpm, the QSK starts to shorten transmitted RF signals and you may get bad tone reports. To correct the situation, Kenwood suggests altering the delay and rise times by changing components in the IF unit (X60-1300-00) as follows:

Make the value of resistor R151 47kΩ, instead of 10kΩ; make the value of resistor R200 100kΩ, instead of 82 kΩ; and make the value of capacitor C166 1 μF, instead of 3.3 μF. These components are located in the IF unit between the optional SSB filter and the front edge of the PCB.

Jussi Torhonen
OH7DC/OH3NWP
Riihimaki Finland

The above items, except "Super Simple Solution" are adapted from International Radio Inc..



Using KK4CS's solution, you touch only the contact you choose.

73 Review

by Michael Simmons WB9CWE

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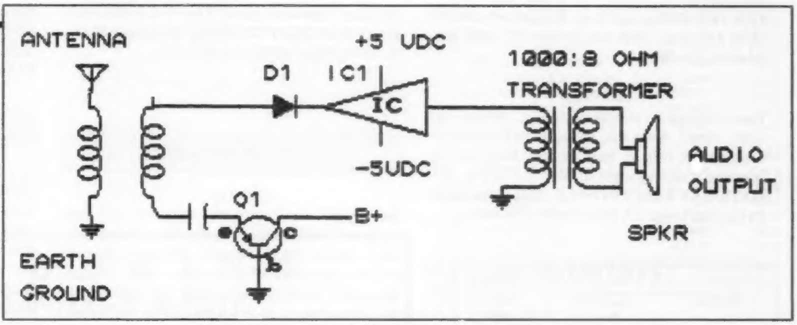

A simple schematic drawn using Flodraw.

Have you ever wanted to use your PC and dot-matrix printer to quickly produce schematic diagrams, but you didn't have the software for it?

For just a few dollars, you can own Flodraw, a graphics editor program with ready-made electronic symbols, and drawing and editing functions.

The Price is Right

Flodraw is shareware, which means you can legally copy it from different sources for free, or for a nominal fee, and evaluate it for your needs. If you don't like it, you can discard it with little or no loss. If you do like it, you can register with the author for $25, or $35 if you want updates and assistance.

Flodraw comes on two disks, and works with most PC compatibles and printers. You don't need a mouse or joystick. Although it's mainly for drawing computer flowcharts, it has libraries for electronic, organization, and other symbols. Just select what you want from the menu.

The library has 22 symbols for drawing schematics. You can modify these and save your modifications and schematic drawings. The beauty of Flodraw is that you can place, move, or edit a symbol, connecting line, or group of components very rapidly and accurately. If you get stuck, you can display the help screen by pressing ALT-H.

Creating and Editing Your File

When you begin, Flodraw will prompt you for the name of your file, type of library, and printing format. Type the name of your file, whether new or previously saved, and select the "Electric" library.

In the editing mode, Flodraw uses a window, which means you only see a part of the total picture. As you bring the cursor across the screen, the window will move across the work area. For rapid movement, you can use the PG UP and PG DN keys. ALT-R and ALT-L move the window right and left.

If you get lost, you can press F2, the View function, for an overview of your whole work area with reduced resolution. An on-screen ruler helps you pinpoint your location.

Pressing the F1 key alternates between the two editing modes: text mode and drawing mode. In text mode, you can type, move blocks of drawing, and call up symbols. In drawing mode, you can refine your drawings and produce connecting lines between components.

For example, let's say you want an antenna symbol. Place the cursor where you want the antenna symbol, press F10 to bring up the symbols, then press the function key which corresponds to the antenna symbol. The symbol will pop onto the screen. Made a mistake? Press F9 and the symbol vanishes.

When you're drawing lines between components, the menu will prompt you on positioning the cursor and let you know when to press F4 to indicate the line's beginning and end.

Using the block functions, you can rotate, delete, copy, or move symbols or groups of symbols anywhere in the diagram you wish.

Producing New Images

You can type text anywhere in the schematic with a number of font sizes. Some symbols, such as the one for IC, are already labeled. You can modify them as you wish. Let's say you need the symbol for an iron core choke. First, call up the transformer symbol. Position the cursor to the left of the unwanted windings, and press the spacebar to erase them. You now have your choke symbol, which may be stored in the library for future use.

Drawing a nonlibrary item, such as a tube or MOSFET symbol, is trickier. You have to call up a circle from the menu, then draw in the lines with the arrow keys. This is a little time-consuming, but not impossible, and once drawn and saved, you'll have it instantly available in the future.

If you've saved a circuit on disk that would be useful in your present diagram, you can use the Merge function to bring it up and place it exactly where you need it.

Printing Your Drawing

Flodraw offers three printing formats: the portrait, 8.5" x 11"; the landscape, 11" x 8.5"; and the large landscape, 16" x 11", or two-page format.

As for hardware, printers which support Flodraw are the Epson, IBM, Toshiba, and any printer which emulates the graphics modes of these printers. My Star NP-10 works well in IBM mode. Print times vary from three to nine minutes, depending on the type of printer, and whether you select single-strike or double-strike printing. The print quality is quite good.

Several Drawbacks

The F9 (Undo) function only works on an immediately preceding operation. If you decide that earlier work needs to be eliminated, you have to use the text cursor and spacebar or the Block-delete function. These are a little cumbersome, and they don't always permit complete erasure of a line or symbol.

Also, when you initially place a symbol on the screen, it will be perfectly placed for clean, easy line connections to other symbols. But if you rotate it, its center will shift, and drawing a straight line to it from another component will be almost impossible. You can get close to connecting a line to one of its ends, but you may have to draw a diagonal line to fully connect. This isn't a major problem; it's just that the connections do not look perfect.

Conclusion

I found Flodraw well worth looking into. A 54-page, well-written instruction booklet and a 15-minute tutorial are included on the disks. They provide excellent help while learning the software.

You can download copies of Flodraw from some computer bulletin boards, or buy a copy for a few dollars from mailorder shareware distributors, such as the one listed at the top of this review. ■

Michael Simmons WB9CWE has been in amateur radio since 1970, and especially enjoys 20m RTTY. He currently owns and runs a small publishing company. Michael can be reached at 101 Harrison Ave., Charlestown IL 61920.

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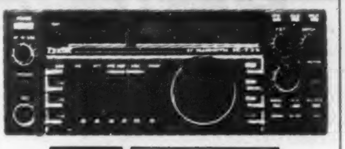

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PROPAGATION

Jim Gray W1XU

by Jim Gray W1XU
PO Box 1079
Payson AZ 85541

October Activity

This month will find excellent HF propagation on all of the HF bands between 40 and 10 meters, and even 80 meters will begin to look a bit lively. The first week of the month will exhibit variable conditions ranging from good to poor, while the second week of the month is likely to be the worst.

Both electromagnetic and geologic conditions will bring surprises—most of them unwanted. The third and fourth weeks of the month will present a vast improvement, down to and including the last days of the month, but due to days of excessive ionization, high absorption can still occur and deep fading may prevail on the DX bands. Six meters will be active, as will 10 on up, as Old Sol races to an early peak of Cycle 22, possibly in mid to late 1990. Make the most of your DX opportunities this month, as many will exist. Keep an eye on developments via WWV at 18 minutes past each hour, and of course, through the charts provided in *73*.

Get Ready for DXing

Use the MUF chart for bands and countries, but use the calendar for daily summaries of conditions. Bear in mind that specific onsets of poor or good conditions may vary by as much as a day or two, due primarily to the increasingly unpredictable nature of the sun at times of high solar activity. Strong sunspot groups can produce flares and sudden ionospheric disturbances that may even create HF communications "blackouts" for several hours at a time on the days marked "P." ■

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	15*	20	20	20	—	—	—	—	—	—	—	15*
ARGENTINA	15	15	20	20	40	—	—	10	—	—	10	10
AUSTRALIA	10	15	20	20	—	40	20	20	—	—	—	10
CANAL ZONE	15	40*	40*	40*	40*	—	20	10	10	10	10	10
ENGLAND	20	40	40	40	—	—	20	10	10	10	15	20
HAWAII	10	15	20	20	40*	40	20	20	—	—	—	10
INDIA	20	20	—	—	—	—	—	15	—	—	—	—
JAPAN	15*	20	20	20	—	—	—	—	—	—	—	15*
MEXICO	15	40*	40*	40*	40*	—	20	10	10	10	10	10
PHILIPPINES	—	—	20	20	—	—	20	15*	15*	—	—	—
PUERTO RICO	15	40*	40*	40*	40*	—	20	10	10	10	10	10
SOUTH AFRICA	40*	20	20	20	—	—	—	—	10	10	10	15
U.S.S.R.	—	40	20	20	20	—	—	10	10	15	20	20
WEST COAST	10	15	20	20	80/40	80/40	—	—	—	10	10	10

CENTRAL UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	10	15	20	20	20	—	—	—	—	—	—	—
ARGENTINA	15	15	20	20	20	—	—	10	—	—	10	10
AUSTRALIA	10	15	15	20	20	40*	40	20	—	—	15	10
CANAL ZONE	15	15	20	20	—	40	40	10	10	10	10	10
ENGLAND	—	—	—	—	—	—	10	10	15	15	20	20
HAWAII	15	15	20*	20	40*	40*	40	20	—	—	10	10
INDIA	—	20	—	—	—	—	—	20*	15	—	—	—
JAPAN	10	15	20	20	20	—	—	—	—	—	—	—
MEXICO	15	15	20	20	—	40	40	10	10	10	10	10
PHILIPPINES	15	—	—	—	—	—	—	20	10	10	—	—
PUERTO RICO	15	15	20	20	—	40	40	10	10	10	10	10
SOUTH AFRICA	20	20	20	—	—	—	—	—	10	10	15*	15
U.S.S.R.	—	—	20	—	—	—	20	15	15	15	20	20

WESTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	10	15*	—	20	20	20	20	20	20	20	—	15
ARGENTINA	10	15	15	20	20	20	—	—	10	—	10	10
AUSTRALIA	10	15*	15*	20*	20	20	40	—	—	—	—	10
CANAL ZONE	10	15	15	40/20	40/20	—	—	—	15*	10	10	10
ENGLAND	—	—	—	—	—	—	—	—	15	20	15	—
HAWAII	10	10	15	20	40*	40*	40	40	15	15	—	15
INDIA	—	20/15(1)	—	—	—	—	—	—	20/15(1)	15(1)	—	—
JAPAN	10	15*	—	20	20	20	20	20	20	20	—	15
MEXICO	10	15	15	40/20	40/20	—	—	—	15*	10	10	10
PHILIPPINES	10	10	—	—	—	—	—	—	20*	15	15	—
PUERTO RICO	10	15	15	40/20	40/20	—	—	—	15*	10	10	10
SOUTH AFRICA	20	20	—	20	—	—	—	—	—	10	15	15
U.S.S.R.	—	—	—	20	20	—	—	—	15	15	20	20
EAST COAST	10	15	20	20	80/40	80/40	—	—	—	10	10	10

* Try next higher band (1) Difficult path

OCTOBER 1989

SUN	MON	TUE	WED	THU	FRI	SAT
1 P-F	2 F-G	3 G	4 G-F	5 F	6 F-P	7 P
8 P	9 P	10 P	11 P	12 P	13 P	14 P
15 P	16 F	17 P-F	18 F	19 F-G	20 G	21 G
22 G	23 G-F	24 F	25 F-G	26 F	27 F	28 F
29 F-G	30 G	31 G-F				

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PAKRATT 232
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MULT SEND CONV
RQ TFC OVER
STA CON CMD TRANS
STATUS
ARQ CHECK PKT MORSE
MODE
RADIO 1

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It's a lesson you learn very early in life. Many can be good, some may be better, but only one can be the best. The PK-232 is the best multi-mode data controller you can buy.

1 Versatility

The PK-232 should be listed in the amateur radio dictionary under the word Versatile. One data controller that can receive seven digital modes, and can be used with almost every computer or data terminal. You can even monitor Navtex, the new marine weather and navigational system. Don't forget two radio ports for both VHF and HF, and a no compromise VHF/HF/CW internal modem with an eight pole bandpass filter followed by a limiter discriminator with automatic threshold control.

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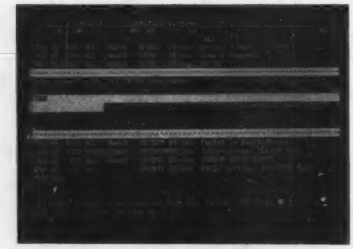

PC Pakratt Packet TX/RX Display

Facsimile Screen Display

2 Software Support

While you can use most modem or communications programs with the PK-232, AEA has two very special packages available exclusively for the PK-232....PC Pakratt with Fax for IBM PC and compatible computers, and Com Pakratt with Fax for the Commodore 64 and 128.

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KENWOOD

pacesetter in Amateur Radio

All New Compact HF!

"DX-citing!"

TS-440S Compact high performance HF transceiver with general coverage receiver

Kenwood's advanced digital know-how brings Amateurs world-wide "big-rig" performance in a compact package. We call it "Digital DX-citement"—that special feeling you get every time you turn the power on!

- **Covers All Amateur bands**
  General coverage receiver tunes from 100 kHz—30 MHz. Easily modified for HF MARS operation.
- **Direct keyboard entry of frequency**
- **All modes built-in**
  USB, LSB, CW, AM, FM, and AFSK. Mode selection is verified in Morse Code.
- **VS-1 voice synthesizer (optional)**
- **Superior receiver dynamic range**
  Kenwood DynaMix™ high sensitivity direct mixing system ensures true 102 dB receiver dynamic range. (500 Hz bandwidth on 20 m)
- **100% duty cycle transmitter**
  Super efficient cooling permits continuous key-down for periods exceeding one hour. RF input power is rated at 200 W PEP on SSB, 200 W DC on CW, AFSK, FM, and 110 W DC AM. (The PS-50 power supply is needed for continuous duty.)
- **Built-in automatic antenna tuner (optional).** Covers 80–10 meters.
- **5 IF filter functions**
- **VOX, full or semi break-in CW**
- **Dual SSB IF filtering**
  A built-in SSB filter is standard. When an optional SSB filter (YK-88S or YK-88SN) is installed, **dual** filtering is provided.
- **AMTOR compatible**
- **Adjustable dial torque**
- **100 memory channels**
  Frequency and mode may be stored in 10 groups of 10 channels each. Split frequencies may be stored in 10 channels for repeater operation.
- **TU-8 CTCSS unit (optional)**
- **Superb interference reduction**
  IF shift, tuneable notch filter, noise blanker, all-mode squelch, RF attenuator, RIT/XIT, and optional filters fight QRM.
- **MC-43S UP/DOWN mic. included**
- **Computer Interface port**

Optional accessories:
• AT-440 internal auto. antenna tuner (80 m – 10 m) • AT-250 external auto. tuner (160 – 10 m) • AT-130 compact mobile antenna tuner (160 m – 10 m) • IF-232C/IC-10 level translator and modem IC kit • PS-50 heavy duty power supply • PS-430/PS-3D DC power supply • SP-430 external speaker • MB-430 mobile mounting bracket • YK-88C/88CN 500 Hz/270 Hz CW filters • YK-88S-88SN 2.4 kHz/1.8 kHz SSB filters • MC-60A/80/85 desk microphones • MC-55 (8P) mobile microphone • HS-4/5/6/7 headphones • SP-41/50/50 mobile speakers • MA-5/VP-1 HF 5 band mobile helical antenna and bumper mount • TL-922A 2 kw PEP linear amplifier • SM-220 station monitor (no pan display) • VS-1 voice synthesizer • TU-8 CTCSS tone unit • PG-2C extra DC cable.

Kenwood takes you from HF to OSCAR!

Complete service manuals are available for all Kenwood transceivers and most accessories. Specifications and prices are subject to change without notice or obligation.

KENWOOD

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